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January-March 2003 Number 1044
Volume 128

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Published by the Yorkshire Naturalists' Union

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Institutions and Subscribers £24.00 Registered Charity No. 224018

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HISTORICAL REVIEW OF THE OTTER (*LUTRA LUTRA* L.) IN THE EAST RIDING OF YORKSHIRE

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Introduction

This review forms the third in a programme of studies (Howes 1976, 1998, 2000) designed to provide a background to current monitoring of the otter (*Lutra lutra* L.) in river catchments, drain network systems and still water of the Yorkshire and Humber region. The wealth of historical allusions gathered from a wide range of sources is presented here as source of background material for the range of otter habitat conservation policies expressed in a range of 'Biodiversity Action Plans' and similar wildlife conservation policy documents adopted by statutory and riparian bodies such as the Environment Agency, Local Authorities, British Waterways, Internal Drainage Boards and the water industry.

Data Sources

Records have been sought from a wide range of archival, published and verbal sources. These include natural history journals (notably *The Naturalist*), topographical and local historical works, press reports and interviews and correspondence with local naturalists, anglers, farmers and other residents. Additional data have been derived from hunting sources via Woodroffe (1994) and UFAW (1969) and reports of the national otter surveys (Stephens 1957, Lenton *et al.* 1980, Strachan *et al.* 1990, Strachan & Jefferies 1996).

The Study Area

The study is based on the historic East Riding of Yorkshire which equates largely with the Watsonian vice-county of south-east Yorkshire (VC61) and includes the current adminitrative area of East Yorkshire. Its northern boundary is delineated in the Vale of Pickering by the Rivers Hertford and Derwent. Its western boundary is formed by the Derwent from Malton to Stamford Bridge. The boundary then cuts southwest to York and continues down the tidal Ouse to its confluence with the Derwent. Its southern boundary extends from the Derwent/Ouse confluence to the Ouse/Humber confluence and thence along the north shore of the Humber estuary to Spurn Peninsula. Its eastern boundary is formed by the North Sea coast from Filey Brigg to Spurn Peninsula.

With regard to English Nature's 'natural areas', the study area comprises the entirety of Holderness and the Yorkshire Wolds and includes sections of the Vale of Pickering south of the Derwent, the Vale of York east of the Ouse; the Humberhead Levels north of the esturine Ouse and east of the Derwent; and the northern section of the Humber Estuary from Faxfleet to Easington.

In addition to the main rivers already mentioned, the study area includes the Wolds tributaries of the Derwent including the Scampston and Settrington Becks; the Blackfoss Beck and the Foulness catchment; the tributaries of the tidal Ouse including the Skipwith and Stillingfleet Becks; the series of flooded clay pits adjacent to the Market Weighton Canal and along the north shore of the Humber to North Ferriby; the Pocklington, Market Weighton, Driffield and Leven Canals; the river Hull catchment including the Driffield, Frodingham and Watton Becks; the still waters of Holderness which include Hornsea Mere and Burton Canstable Park lake; Holderness drains which include the west flowing Barmston Drain which enters Bridlington Bay and the south flowing Winestead and Ottringham drains which pass into the lower Humber estuary.

Place Name Evidence

Place name evidence in the form of Ottringham (TA/2624), if referable to otter, rather than a personal name, e.g. the Scandinavian 'Oder' (Smith 1937), may suggest their presence

prior to the availability of documentary sources and prior to early wetland drainage schemes.

Pre-19th Century Bounty Payments

Bounty payments (head money) for otters relating to period from the late 16th to the early 19th centuries regularly feature in the yearly accounts of churchwardens and other officials of riparian parishes or townships. Examination of extensive series of accounts from 23 East Riding parishes located 'vermin' payments in twelve (52%) parishes. Curiously, considering the presence of major river catchments and wetlands within the region, the exercise failed to locate evidence of otter bounties being paid in potentially suitable riparian parishes (see Table 1).

TABLE 1
Success rates in locating otter bounty records in churchwardens' accounts of twenty-three East Riding parishes.

Parish	Appropriate date range	Vermin bounties	Otter bounties
Aldbrough	*	–	–
Beverley (St Mary's)	*	*	–
Catwick	*	–	–
Cottingham	*	*	–
Eastrington	*	–	–
Elloughton & Brough	*	*	–
Garton in Holderness	*	–	–
Hilston	*	–	–
Hollyn cum Withernsea	*	–	–
Holmpton	*	–	–
Hotham	*	–	–
Howden	*	–	–
Langtoft with Cottam	*	*	–
North Ferriby	*	*	–
Patrington	*	*	–
Roos	*	–	–
Routh	*	*	–
Sigglesthorne	*	*	–
Skirlaugh	*	*	–
South Cave	*	*	–
Wawne	*	–	–
Wold Newton	*	*	–
Wressle	*	*	–
Total % of 23 parishes	**23**	**12 (50%)**	**0 (0%)**

Otter Hunting

From the mid-19th century to the 1960s, the middle and lower reaches of the River Derwent, which forms respectively the northern and western boundaries of the old East Riding (VC61), was celebrated for otter hunting. The Durham City and Stockton Otter Hounds worked the Derwent in the Vale of Pickering in 1863 (Hatfield 1866) and Sir Charles Legard's hounds hunted at Thicket Priory and on the Pocklington Canal in 1890 (Tyke 1890). During 1921 and 1922, the Kendal and District Otter Hounds temporarily

split to form an eastern pack named the Rydale and District Otter Hounds. These were based at Malton to work the Derwent and its tributaries (Baily's Hunting Directory 1973-74).

The Malton and District Otter Hounds, which was established with ten pairs of hounds, appear to have succeeded the Rydale pack on the disbandment of the Staffordshire and Yorkshire Otter Hounds. Their hunting territory included the Rivers Derwent and Hull of the East Riding together with their tributaries and associated carrs (Baily's Hunting Directory 1973-74). Woodroffe (1994) was privileged to be able to examine the hunting diaries of the Malton Otter Hounds which showed that during the 1950s and 1960s some eleven different hunting venues were visited on the Derwent with some 28 km of river being worked. The diaries, covering the period 1933 to 1968 (excluding the years of the Second World War and immediately after) showed that in 26 outings some 24 otters had been encountered.

Using data from Wooroffe (1994) and UFAW (1969) to calculate the success rates for the three decades (represented in terms of the numbers of otters encountered per 100 days of hunting), a substantial decline is indicated from an index of 106.6 for the 1930s to 50.0 for 1967 and 1968 seasons (see Table 2).

TABLE 2

Annual numbers of outings and finds recorded by Malton Otter Hounds on the Yorkshire Derwent (abstracted from Woodroffe 1994, +Anon 1969 and *UFAW 1969)

Year	Outings	Finds	Equivalent to per 100 days hunting
1933	4	6	
1934	7	7	
(+1937			38)
1939	4	3	106.6
(+1947			75)
1950	3	4	
1952	2	0	
1954	1	1	83.3
(+1957			67)
1959	1	0	
1960	2	2	66.6
*Late 60s (3 yrs.)	15		53.3
(+1967			20)
1967	1	0	
1968	1	1	50.0

General Status Reviews

In the late 19th century, Clarke and Roebuck (1881), reviewing the data available to them, regarded the otter as occurring 'in limited numbers in all the rivers', though it was 'apparently absent from Holderness'. Procter (1922) regarded the otter as still 'very rare in Holderness' but 'fairly common on the upper reaches of the river Hull and the chalk streams of the Wolds, where . . . it is again increasing'. Sheppard (1927) knew of them occurring only 'occasionally in trout streams and more inaccessible parts'. In her questionnaire survey of national River Boards, Stephens (1957) received no response from

the Hull and East Yorkshire River Board so she assumed otter status was as high as in the non-industrial catchments of the Yorkshire Ouse River Board (Pennine and Vale of York) region, though she had evidence that they were 'scarce around Hull'.

East Riding sites monitored by The National Otter Surveys

A small number of sites in the East Riding have been included in four published national surveys on otter status and distribution. The first (Stephens 1957) was undertaken from 1952 to 1954, largely through correspondence with River Board managers and Otter Hunt masters (see above). In 1977 to 1979 (Lenton *et al.* 1980), 1984 to 1986 (Strachan *et al.* 1990) and again from 1991 to 1994 (Strachan & Jefferies 1969) the Nature Conservancy Council monitored trends in otter distribution in England. This was achieved by the standardised examination of sample sites along designated stretches of riparian habitats within the north-western and south-eastern quarters (50 km squares) of alternate 100 km squares of the national grid. Sadly most of the East Riding is missed by this system; only that area which falls within 50 km square SE south-east (east from the Derwent and north of the Ouse and Humber to northing SE/50) is included. The included region, however, includes 16 highly significant sampling sites on the lower Derwent and Pocklington Canal catchment, a further ten on the Foulness and Market Weighton canal catchment, three on the lower Ouse banks and four on the north Humber bank. In the September and October 1978 survey all sites were negative (Lenton *et al.* 1980), yet during October 1985 one site on the Pocklington Canal was positive (Strachan *et al.* 1990) and during the 1991 to 1994 survey twelve regular sample site plus two spot check sites proved positive (Strachan & Jefferies 1996).

Release Programmes

Following a detailed survey of the North York Moors National Park rivers, a number of sites were selected to receive otters for release. From 1991 to 1993 the restocking programme, undertaken in co-operation with the Environment Agency and English Nature and co-ordinated by the Vincent Wildlife Trust, introduced 21 rehabilitated wild orphaned and injured or captive bred otters, largely from Scottish sources, into the River Derwent system. Table 3, based on Strachan and Jefferies (1996), indicates releases onto the Derwent on the East Riding boundary. Collectively, the surviving release animals have successfully established themselves as a breeding population and now occupy the majority of the Derwent catchment; indeed, it was judged likely that all the positive 1991 to 1994 national survey evidence in the lower Derwent resulted from a re-establishment programme (Strachan & Jefferies 1996). This population may also be the origin of animals now being monitored on the Foulness catchment.

TABLE 3

Numbers, sexes, release sites and dates of release of captive-bred and rehabilitated otters on the Derwent system adjacent to the East Riding.

Date	Locality	Numbers & Sexes	
		Males	Females
April 1992	Thornton Ings	2	1
May 1992	Buttercrambe	3	0
July 1992	Thornton Ings	0	1
September 1992	Thornton Ings	1	1
July 1993	Buttercrambe	1	1
Total		**7**	**4 (11 Otters)**

Up to 1996 there were four known losses from this programme. In 1992 two released males were drowned in a single illegally set eel fyke net, a female was killed on the road 18 months after release (Woodroffe 1993) and a specimen was found dead near pheasant rearing pens (Strachan & Jefferies 1996).

Review of Otter Records by River Catchment, Drain Network or Water Body

The approximate locations of records for which specific sites have been traced are indicated as solid dots on Figure 1. No attempt has been made to differentiate records from different date periods.

Yorkshire Derwent – Ayton downstream to Malton

On Whit Monday 1863 the Ayton to Ganton stretch (SE/97) was successfully worked by the Durham City and Stockton Otter Hounds (Hatfield 1866). In March 1895 many fresh footprints and a freshly killed pike (*Esox lucius*) were found on the river bank down stream of Ayton (SE/97) (Hay 1895). Although the Vale of Pickering reaches of the Derwent were regularly hunted, notably by the Malton Otter hounds, in 1889 the proprietor of the Scampston estate declared that otters were to be 'preserved' in Scampston Park (SE/8675) (St Quintin 1889). In the autumn of 1919 otters entered the park on two occasions, killing

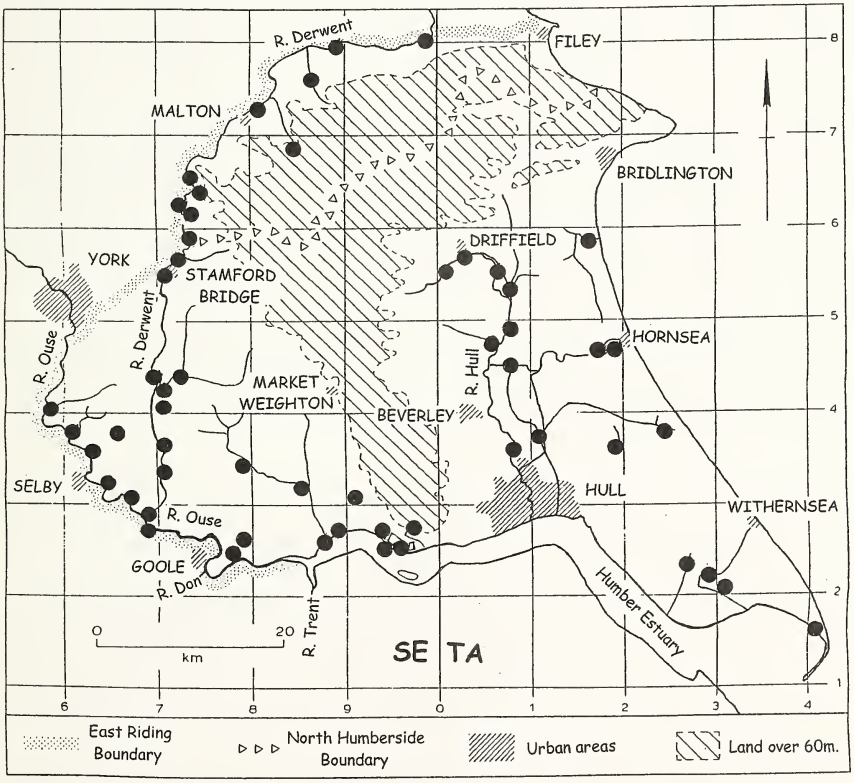

FIGURE 1
Distribution of otters in the East Riding of Yorkshire.

captive examples of Ross's, Snow (*Chen caerulescens*) Brent geese (*Branta bernicla*), Curlew (*Numenius arquata*) and 9 ducks (Anatidae) from the waterfowl collection. A female otter weighting 14lbs visited on 15th May 1922 and was trapped after killing a captive lesser white-fronted goose (*Ansa albifrons*), a Japanese teal (*Anas* sp.) and destroying several clutches of eggs (St Quintin, 1923). In 1976 otters were reported at Yedingham (SE/8979) (Thompson 1977).

Yorkshire Derwent – Malton to Stamford Bridge

On the Settrington Beck, a Wolds tributary of the Derwent, an otter was recorded at North Grimston (SE/8367) in 1902 (Fraser 1902). On 14th January 1931 the remains of a brown trout (*Salmo trutta*) allegedly killed by an otter were reported at Malton (SE/8072) (Smith 1932). Otters were reported repeatedly in 1931 and were regarded as being 'comparatively plentiful' and that 'a number of cubs had been killed' (Smith 1932). Otters were present on the river in 1933 as indicated by spraints (York Naturalists' Society Report Book).

Otters were recorded on the stretch at Kirkham (SE/7365) in 1889 (Walker & Longster 1889) and according to fish remains left on river banks they still frequented the area in 1920 (Smith 1920). At nearby Howsham Bridge (SE/7362) one was seen in 1977, (Yorkshire Mammal Group) and on 7th May 1978 spraints and prints were found at three points along the river (SE/7463) (Yorkshire Mammal Group) and on 25th January 1981 footprints were again located along the river bank at Howsham Wood (SE/7463) (Yorkshire Mammal Group).

In the winter of 1910 a pair of otters occupied a holt in the roots of a pollarded willow in a beck between Buttercrambe and Stamford (SE/7256) (York Naturalists' Society Report Book). Two otters were reportedly seen at Buttercrambe in 1981 and spraints were located on the weir there (SE/7358) on 22nd February 1981 (Yorkshire Mammal Group).

In spite of further reported sightings in 1984 and 1986, regular surveying by Laura Winter (unpublished) from 1987-1989 at eight sites between Malton (SE/7871) and Scrayingham (SE/7360) found only a single spraint (Woodroffe 1994).

Yorkshire Derwent – Stamford Bridge to the Ouse confluence

This ryver at great raynes ragith and overflowith much of the ground there aboute beyng low meadowes (Leland 1520s).

John Leland's allusion to the lower reaches of the Derwent and its surrounding landscape describes the river's natural propensity to create substantial wetland regions, as at Wheldrake Ings, particularly in times of high rainfall. Today, the Tidal Barrage at the Derwent's confluence with the estuarine Ouse, has effectively removed the tidal element from the lower river and holds the riparian habitats under inundation for much longer periods than was formerly the case.

At Stamford Bridge (SE/7155) on 18th July 1909 the remains of a brown trout (*Salmo trutta*) allegedly killed by an otter were reported (Roebuck 1910). An otter was reported in the Stamford Bridge area in 1913 (Smith 1913) and one was again seen in the area in 1977 (YNU unpublished records).

A note in the *Field* for 1890 reported that Sir Charles Legard's otter hounds working the Derwent at Thicket Priory (SE/6943) had killed a female otter (Tyke 1890). In 1912 one was seen at Menthorpe Ferry (SE/7034) (*YNU Annual Report* for 1912), in January 1920 a 19lb male otter was killed on the Derwent bank at Bubwith (SE/7036) (York Naturalists' Society Report Book) and in 1933 otters were regarded as 'frequent' in the Derwent near Skipwith (SE/63) (Smith 1933). In 1976 one was seen at Wheldrake Ings (SE/7043) (Thompson 1977).

During surveillance for the national otter surveys of 1978 and October 1985 the five sampling sites on the lower Derwent main river (within the south eastern quadrant of the 100 km square SE) proved negative (Strachan *et al.* 1990). However, the survey of 1994 located signs at all five sites together with an additional spot check site. Only two sample

sites on tributaries remained negative (Strachan & Jefferies 1996). Collectively, the 16 full sites and two spot check sites on the lower Derwent, Pocklington Canal and Blackfoss Beck complex provided 14 positive records for this system which provides some excellent habitat (Strachan & Jefferies 1996). Strachan and Jefferies (1996) were of the opinion that all the evidence encountered was from otters released into the Derwent system from 1990 to 1994.

Pocklington Canal catchment

In 1890 Sir Charles Legard's otter hounds had worked the Pocklington Canal (SE/74) (Tyke 1890). In about 1974 an otter was shot at East Cottingwith (SE/7042) (Thompson 1977) and on the 16th October 1985 otter signs were located at Hagg Bridge on the Blackfoss Beck/Pocklington Canal confluence (SE/7145). During the 1994 national survey seven of the ten sample sites together with an additional spot check site provided positive signs; these included continued presence at the Hagg Bridge site (Strachan & Jefferies 1996).

Foulness catchment

On 29th December 1915 and again on the 1st January 1916 single female otters were killed at Spaldington (SE/7934) (Booth 1917). During surveillance for the national otter surveys of 1978 and October 1985 and 1994, the ten sampling sites on Foulness catchment (SE/73; 83) remained negative (Strachan & Jefferies 1996). However, sight inspections undertaken from winter 1999 to summer 2000 confirmed presence on the Foulness catchment (SE/73, SE/83) (Lavelle 2001).

Lower Ouse and adjacent wetlands

In January 1903 a 24lb otter was killed at Cliffe (SE/6630) (*Goole Times and Weekly Herald* 1903). In 1912 sightings were reported from the Ouse near Drax (SE/6728) and the Turnhead reach, Barlby (SE/6728) (Fortune 1913) and in 1931 otters were repeatedly reported from the Ouse and were regarded as 'comparatively plentiful' (Smith 1932).

Curiously there are no specific lower Ouse records from naturalists' sources for four decades until signs were reported at Saltmarshe Delph (SE/7724) on 22nd June 1974 and an otter was seen at Laxton (SE/7925) early in 1980 (S. Holliday *pers. com.*).

Surveillance at 17 sampling sites on the lower Ouse (including the Skipwith and Stillingfleet Becks) for the national otter surveys of 1978 and 1994 failed to reveal signs of otters, though on 10th October 1985 a single site was positive by Stillingfleet Beck (SE/5840). This was probably from a transient animal and since that time there have been occasional unconfirmed sightings of single otters from this stretch (Strachan & Jefferies 1996 J. Birks & R. Strachan *pers. comm.*).

South Wolds streams and Market Weighton Canal

In the streams of the Market Weighton region (SE/84) otters were present in 1897 (Boyes 1897) and were 'seen occasionally' in 1909 (Marshall 1909). On 23rd February 1902 an otter was shot near South Cave (SE/9130) and on 30th April 1903 one was shot as it emerged from a drain at Welton (SE/9627) (Hill 1907).

In December 1911 an adult and a cub were shot in the flooded disused clay pits by the Market Weighton canal at Sandholme Landing (SE/8531) (*Goole Times & Weekley Herald* 1911). At Gilberdyke (SE/8328) a female was shot and a cub captured on in January 1916 (*Goole Times & Weekly Herald* 1916). Prior to 1970, otters were seen by a farmer on several occasions on a Humber tributary (SE/82), probably the Market Weighton canal (Lenton *et al.* 1980).

Humber shore clay pits

Near Brough in August 1925, up to four were reported frequenting a 'reservoir' [clay pit] and an outfall stream to the Humber (SE/9326) (Smith 1926). Otters were known to

'occasionally visit' the Humber bank at North Ferriby (SE/9624) in 1944 (Procter 1944) and in 1947 otters were seen at the Melton clay pits (SE/9524) (Hazelwood 1948). On 28th June 1962 tracks were followed through the Phragmites reed beds on the Humber bank near Broomfleet (SE/8826) and two otters were seen by anglers on a nearby pond (Govett 1963). In 1967 otters were reported to the west of Hull (Clegg 1968) and in December 1979 fresh spraints were seen in the flooded disused clay pits by the Humber at Welton Ponds (SE/9525) (Hull Naturalists' Society *pers. comm.*). During surveillance for the national otter surveys of 1978 and October 1985 and 1994, the four sampling sites on the Humber all remained negative (Strachan & Jefferies 1996).

River Hull catchment

From the late 19th century there is a reasonably continuous record of occurrence. They were known but regarded as 'rare' in the Driffield Beck in the Driffield area (TA/0256) in 1890 (Boyes 1890) and again in 1899 (Boyes 1899). On 29th May 1902 one was killed in the 'trout stream' at Driffield (TA/0356) (Hill 1907). A male otter was captured near Driffield (TA/05) in 1902 (*Eastern Morning News* 1902; Anon 1903). A 12lb female was captured near Driffield (TA/05) in February 1903 (Anon 1903), two were killed in the Driffield Beck at Sunderlandwick (TA/0155) on 4th March 1903 (Hill 1907) and on 28th April 1903 a 25lb male and a 15lb female were shot on the Kelk Beck at Lowthorpe (TA/0860) (Hill 1907). In referring to status in the Driffield area (TA/05), Procter (1922) noted that otters were 'fairly common on the upper reaches of the River Hull and the chalk streams of the Wolds', and in 1933, Procter (1939) suggested that 'though the appearance of otters is rare, they are secretive and more numerous than is generally thought'. They were regarded as occasional visitors to the area in 1950 (Saith 1950) and were still present in 1962 (Govett 1963). An otter pelt in the possession of Mr C. Grantham of Driffield was from an animal killed locally in the early 1960s (T. G. Manby *pers. comm.*).

In the summer of 1964 otter tracks were found in several places along a two mile stretch of the exposed mud banks of the tidal river Hull up stream of Hull Bridge, Beverley (TA/04). Spraints and the chewed remains of an eel (*Anguilla anguilla*) were also found (Govett, 1965). In 1971 otters were reported on Watton Beck (TA/0647) and at Toplock Low (TA/0748) (Hull Natural History Society *pers. comm.*) and on 6th May 1979 signs in the form of a characteristically chewed grayling (*Thymallus thymallus*) was found on the bank of the Driffield Beck at Wansford (TA/0656) (Howes 1980).

In 1991 and 1992 Edwin Pretty (*pers. comm.*) regularly obtained good sightings of otters entering and leaving a holt site amongst willows and *Phragmites* reeds in the Hempholme Lock area (TA/04). Following this report, in the January and February of 1995 a detailed survey involving the examination of almost 100 sites along the river Hull located positive signs (4 spraints and 1 footprint) at five sites all up stream of the confluence of the Hull and the Frodingham Beck (TA/0752) (Jay 1995 & *in litt.*). Several unconfirmed sightings were also reported by ornithologists at Tophill Low Reservoir Nature Reserve (TA/0749) (Crowther 1995), and detailed surveys in the headwaters of the river Hull from winter 1999 to summer 2000 have confirmed regular otter activity with additional sites being added on the Frodingham Beck (TA/0852) and the Leven Canal (TA/0745) (Lavelle 2001).

Otters utilised the catchment further down stream, though records are less common. At Hull Bank Hall (TA/03) in the 1850s footprints were identified in the mud by a pond (Harworth-Booth 1900) and an otter was seen here in June 1901 (Shepperd 1902). Breeding was proved in the lower Hull valley in 1928 when on 9th February two young otters were dug out of a section of Sutton Drain near Wawne (TA/1037). Otters were present in the Dunswell area (TA/0735) between 1945 and 1950 (Rider 1969).

Holderness

Lordinges, ther is in Yorkshire, as I guesse,
A mersshy contree called Holderness.
The Sumnours Tale, Geoffrey Chaucer Late 14th century

An examination of the surface drift deposits of this region (Arnett 1990) shows considerable areas of Holocene fen peat and alluvium in the central Hull valley, indicating equivalent areas of former wetland. In addition were the series of post-glacial meres and networks of meandering drainage runnels generally running west off the underlying compacted Skipsea Till boulder clay into the Hull catchment, or south into the Humber marshes. Pollen analysis of peat deposits (Beckett 1981) shows abundant evidence of the wetland and riparian indicator tree common alder (*Alnus glutinosa*), suggesting that conditions would have been suitable for otters.

The progressive and hugely influential drainage schemes, commencing largely in the 1760s (Sheppard 1958) massively reduced the gross areas of permanent and seasonal wetlands, and Hornsea Mere, though the largest natural lake in Yorkshire, is now the only surviving example of the Holderness meres. The alder pollen record, which declined markedly in more recent superficial deposits, appears to reflect the post-drainage replacement of wetland with arable agriculture.

The current landscape, characterised by geometrical networks of clinically maintained drainage systems, provides relatively limited habitat opportunities for otters. However, a residual population still occupies these waters and with sympathetic management of riparian habitats and fish stocks and a control of pesticidal loadings reaching the water courses, a sustainable future may be possible.

Although Clarke and Roebuck (1881) regarded otters as being 'apparently absent' in Holderness, and up to the 1920s they were regarded by Procter (1922) as 'very rare in Holderness', a significant series of scattered records have come to light.

At Hornsea Mere (TA/14), George Bolam found no evidence of otters and John Taylor, game keeper on the Wassand estate on which the Hornsea Mere is situated, claimed not to recall otters in the area during his many years service around the turn of the 19th century (Bolam 1913). However, after the First World War, records began to come to light. On 22nd May 1926 a pike (*Esox lucius*) was found with characteristic wounds in its shoulder proving the first, if circumstantial, evidence of otter on the mere (Badland 1926, Procter 1935). In 1947 breeding was confirmed (Hazelwood 1948) and otters were again noted in 1950 (Hazelwood 1951). Single otters were sighted on 26th November 1970 (W. Curtis *pers. comm.*), 19th May 1971 at Swan Island (TA/1746) (J. Hawley *pers. comm.*), at the western end of the Mere (TA/1646) also in 1971 (Hull Naturalists' Society *pers. comm.*), and again at the western end at 3.40 p.m. on 20th November 2000 (W. Curtis *pers. comm.*).

To the north of the Holderness area, one was killed at Barmston Drain (TA/1658) in about 1890 (Harworth-Booth 1900). Further south, shortly before 5th December 1928, a specimen weighing 8.5lb and measuring 28 inches in length was trapped at Aldbrough (TA/2438) (*Hull Daily Mail* 5.12.1928, Anon. 1929) and a pair was present on Burton Constable Park lake (TA/1835) in 1947 (Hazelwood 1950).

On the southern fringes of Holderness on 9th December 1892 a 21lb male otter was shot on the Humber bank near Kilnsea (TA/41) (Cordeaux 1893). That most critical of observers, Ralph Chislett (1946), reported footprints in the tidal dykes, also near Kilnsea. In April 1961 an otter was seen in Winestead Drain (TA/3020) (B. Pashby *pers. comm.*), and on the 17th and 18th February 1962 two were seen near the railway track at Winestead (TA/2923) (Govett 1963). The most recent sighting in this area was at Ottringham (TA/2724) in 1976 (Howes 1980).

Contrasting with the pre-Second World War allusions to absence or scarcity in Holderness (Clarke & Roebuck 1881, Bolam 1913, Procter 1922) by the late 1940s the region was regarded as something of a stronghold for otters, with Hazelwood (1950) noting them as being 'numerous in the Holderness area'.

Summary and Discussion

Bounty payments

The apparent absence of otter bounty payments being made in riparian parishes during the 16th to early 19th centuries, contrasts with equivalent studies in the Humberhead Levels (9% of parishes) (Howes 2000) and Nottinghamshire (26% of parishes) (Howes 1998). This could either indicate that otters were not perceived as a competitive threat to local fisheries, that other mechanisms (as yet unknown) were in place to control otters, or that otters were absent or genuinely scarce in east Yorkshire and only colonised the region during the 19th century. This would seem highly unlikely since this period coincides with the height of shooting estates and the efficiency of the gamekeeping profession when culling pressure would have been intense, certain species of larger British carnivores were driven to the brink of extinction (Langley & Yalden 1977) and otters met with local extinctions (Howes 1976).

Status changes in Holderness

Although status reviews relating to Holderness from the late 19th century to the first quarter of the 20th century (Clarke & Roebuck 1888, Bolam 1913, Procter 1922) suggest that otters were indeed absent or very scarce across in this region, this may have been an artificial situation created by unpublicised culling on numerous game estates. With estate staffs leaving for or losing their lives during the First and Second World Wars, or because of the financial collapse of some of the landed estates at this time, the wartime and post-war culling pressure was likely to have been significantly relaxed, resulting in population increase. This would help explain the sightings and breeding records during the 1940s and justify the claim by Hazelwood (1950) that Holderness was now (immediately prior to the widespread use of organochlorine pesticides) a stronghold for otters.

Population Monitoring

By using otter hunting data from the Malton and District Otter Hunt via Woodroffe (1994) and the Universities Federation for Animal Welfare (UFAW 1969) it has been possible infer population changes in the Derwent system by expressing statistics in terms of the numbers of otters encountered per 100 days of hunting.

In the 1930s the numbers of otters encountered per 100 days of hunting provided an index of 106.6. With the cessation of otter hunting and game keeping during the Second World War, the otter population could be expected to have rallied, as was evidently the case across Holderness. However, the seasons of 1950 to 1954 produced an index of only 83.3 finds per 100 days of hunting. This is a significant post-war baseline figure, Table 2 showing a progressive decline, with the index of finds for the seasons of 1959 and 1960 dropping to 66.6, for a three year period in the late 1960s to 53.3 and for the seasons of 1967 and 1968 dropping to 50.0. If the 1930s (pre-war) figure is ignored, the timing of this decline coincides generally with the major 'crash' in otter populations in the eastern counties identified by Chanin and Jefferies (1978) and ascribed to the rapid and lethal effects of the introduction in 1956 of Aldrin, Dieldrin and Heptachlor organochlorine seed dressings and sheep dips (Strachan & Jefferies 1996). The unpredicted drop from five occupied waters in the under-recorded 1940s to just two occupied waters in the 1950s (see Table 4) when hunting re-commenced, may also be attributable to mortality of otters through the biocidal effects of organochlorine residues reaching the water courses from this intensively arablised region.

Distribution monitoring

Table 4 summarises the twenty-one waters from which otter evidence has been collated and categorises the periods during which otters are known to have been present. These in turn have been grouped into seven discrete catchments.

Records from hunting, topographical and naturalists' sources show that during the latter half of the 19th century, otters occurred on the Derwent from Ayton to its confluence with

TABLE 4
Chronological review of otters on East Riding rivers and wetland sites

River catchment and water body	1850s - 1890s	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Total post 19th century decades
Derwent (Ayton - Malton)			*	*					*			*	4
Derwent (Malton - Stamford Br.)	*		*	*	*		*		*	*			6
Derwent (Stamford Br. - Ouse)	*	*	*		*				*	*	*	*	7
Settrington Beck		*											1
Pocklington Canal	*								*	*	*	*	4
Foulness catchment			*									*	2
Lower Ouse		*	*		*				*	*			5
South Wolds streams & Mkt. Weighton Canal	*	*	*					*					3
Humber shore & clay pits (above Hull)			*	*		*		*	*				5
Driffield Beck & chalk streams	*	*		*	*		*	*	*		*	*	8
River Hull (above Beverley)								*	*		*	*	4
River Hull (below Beverley)	*	*		*		*							3
Frodingham Beck												*	1
Watton Beck									*				1
Leven Canal												*	1
Barmston Drain	*												0
Hornsea Mere				*		*			*			*	4
Burton Constable Lake						*							1
Winestead Drain								*					1
Ottringham Drain									*				1
Humber shore (below Hull)	*					*							1
Total river systems / waters	8	6	7	6	4	5	2	5	11	4	4	9	

the Ouse, on the newly constructed Pocklington Canal, the south flowing Wolds streams, the Driffield Beck and River Hull, the Barmston Drain and the brackish dykes leading to the Humber shore at Kilnsea.

For each decade from the 1900s, Table 4 lists and totals the waters for which otters have been recorded within the study area. Numbers of occupied waters oscillated from four to seven between the 1900s and the 1940. The cessation of otter hunting during the 1940s due to the Second World War resulted in the decade being under-recorded, with records coming from only five waters. Usual hunting activity on the Derwent could have added between two and three additional water sections. In the 1950s, even with the resumption of otter hunting on the Derwent, the number of positive waters suspiciously dropped to just two (the Driffield Beck and the Derwent between Malton and Stamford Bridge). In the 1960s the figure returns to five but in the 1970s increased to an unprecedented eleven. This is likely to be a reflection of high levels of recorder effort by members of the Yorkshire Naturalists Union and the newly formed Yorkshire Mammal Group in recording sites for the national mammal atlas scheme promoted by the Mammal Society and the Biological Records Centre, and for the Yorkshire mammal atlas (Howes 1983). During the 1980s and 1990s, despite sample work within the region for the national otter surveys of 1984-86 and 1991-94, the number of occupied waters remained at four. In 2000, however, the positive results of the otter releases on the Derwent system are being confirmed on additional stretches and adjacent waters and the population confirmed on the Hull catchment is similarly expanding, giving a total of nine waters from which positive signs have been confirmed.

Of the 21 waters listed in Table 4, Barmston Drain has received no positive sightings since the 19th century and a further eight waters have only produced records in one decade since the 19th century. Optimistically, two of these (Frodingham Beck and the Leven Canal) are new additions from the year 2000. The Foulness catchment also proved positive in 2000 for the first time in eight decades.

The most consistently occupied waters are the Derwent from Ayton to Malton, the Pocklington Canal, the River Hull above Beverley and Hornsea Mere with records from four decades. The lower Ouse and the Humber shore and flooded clay pits up-stream of Hull both had records for five decades, though with no positive sightings at the clay pits since the 1970s it is possible that increased disturbance by recreational interests may prove a deterrent for animals which may potentially establish in future. The Derwent from Malton to Stamford Bridge has records for six decades, the Derwent from Stamford Bridge to the Ouse confluence has records for seven decades but the most consistently recorded water in East Yorkshire is the Driffield Beck and associated chalk streams with records for eight decades. All these waters and catchments should form a focus for conservation management in appropriate regional and local Biodiversity Action Plans.

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BOOK REVIEW

A Guide to the Wetland Heritage of the Vale of Pickering by **Noel Menuge.** Pp. 54, with 32 plates, 16 in colour and 3 maps. Published by the PLACE Research Centre of York, 2001. £4. Glossy paperback.

This little book of 54 pages in total is concerned with the history of land exploitation in the Vale of Pickering from the time of the earliest inhabitants to the present day and includes extracts from interviews with present inhabitants. There is a strong bias towards land drainage issues and an appendix of 5 pages deals with the drainage methods and techniques that have been employed in the Vale. The maps appear to be photocopies of very early nineteenth century prints and, apart from the features that have been inked over, are so faint that they are difficult to read and discern. Thus those not familiar with the Vale might not immediately realise that the third map is an extension of the second.

A final section of 5 pages deals with the wetland fauna and flora that have survived human activities. The comprehensive bibliography of 9 pages consists of primary sources (documents, oral/living history sources and maps) and general reference books.

DJB

RECLAMATION, RESURGENT RABBITS AND TRANSLOCATION

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INTRODUCTION

The purposes of this paper are threefold: (a) to comment on the influence of rabbits on the fortunes of two grass species, and eight forbs, sown for restoration purposes onto limestone quarry spoil in 1984, (b) to report on the progress, with and without the presence of rabbits, of ten additional plant species translocated in 1994, as locally gathered seeds or fruits, into the grassy vegetation, (c) to discuss the ecological restoration of limestone spoil, and the likely merits, of several species not commonly used.

The spoil under consideration is a north facing slope (Fig. 1) at the eastern end of Skipton Rock Quarry (SE 015529) in North Yorkshire. The slope is, for the most part, between 7° and 20°. It is prone to summer drought, and the substratum has a pH of around 8.2. Physical and chemical characteristics of the material, which comprises waste from crushing and washing processes, were described by Dixon and Hambler (1993). Stones are abundant, and characterise the surface appearance.

The slope was sown in 1984 with *Festuca rubra*, and *Agrostis stolonifera*, species long accepted as suitable for reclamation work in limestone quarries (see Bradshaw and Chadwick 1980; Richardson and Evans 1986) together with smaller amounts of commercial forbs. Cultivars of the grasses had been carefully selected through local experiments to give an optimal performance on the site. The forbs comprised native species, not all of British provenance. In addition, a number of native tree and shrub species were planted as 'whips'; these will not be discussed in detail here.

The course of events on the spoil from 1984 to 1994, involving sown and immigrant species, was recorded by Dixon and Hambler (1993) and Hambler *et al.* (1995). The spoil habitat into which ten species were experimentally introduced in 1994 had thus already been modified by commercial and immigrant plants, and by rabbits.

After a decade, the vegetation had long contributed to a prime purpose of stabilising the surface, yet it was still conspicuously stony and the appearance of the slope was disappointing. Rabbits (*Oryctolagus cuniculatus*) seemed partly to blame, although, as was reported in the two last mentioned papers, their influence was, at first, judged beneficial to the reclamation (Dixon & Hambler 1993) as their middens caused the grasses to overrun stones, and provided habitats for earthworms and other invertebrates. The numbers of rabbits observed in the environs of the spoil at any one time fluctuated widely over the years between 1984 and 2002, and subjective judgement suggests that a very large metapopulation existed at times. A photograph (Plate 4c) shows the results of their considerable activity in the relict pasture (Z on Fig. 1) at the eastern end of the site.

In the discussion section of this article we will venture our opinions on the relative suitabilities of the locally translocated species for restoration of grassland on limestone quarry spoil, and on the 'ethics' of translocation applied to one of these which is 'nationally scarce'.

A RABBIT PROBLEM

The magnitude of a rabbit 'problem' on the spoil was first appreciated through covering small areas with wire-mesh office trays, sowing seeds of a native plant palatable to rabbits under each and also in an adjacent 'control' area. The outcome of such replicated experiments, where rabbit-palatable species such as *Anthyllis vulneraria* were destroyed except where protected, led to the completion, by mid-September 1994, of a small rabbit exclosure (X on Fig. 1). The vegetation in the vicinity appeared uniform at that time. The surface within the exclosure appeared more intensely green by 26 October, and was very distinctly green by the end of November with tufts of *F. rubra* now conspicuous. The vegetation became increasingly floriferous within the first two years; and trees and shrubs,

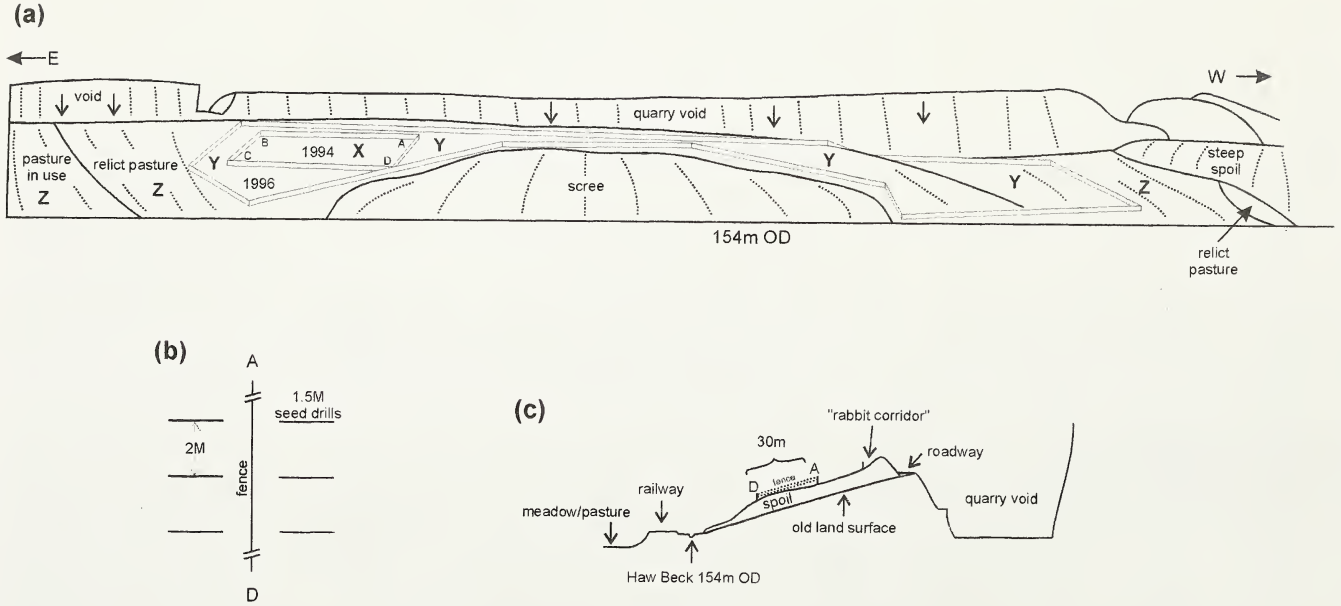

FIGURE 1

(a) Quarry soil slope viewed from the north. X indicates the 1994 35 m x 35 m exclosure with fences A-B-C-D; Y indicates the area from which rabbits were excluded in 1996; Z indicates area with continual rabbit access: (b) arrangement of seed drills (three only shown) on either side of A-D: (c) section of quarry site with A-D shown; the position of the southern fence of Y is indicated – the 'rabbit corridor' is between this and the spoil summit.

PLATE 1

Grasses (a) inside and (b) outside the 1994 exclosure in June 1996, with *F. rubra* (narrow leaves) the more conspicuous inside; (c) in June 2002 after the rabbit resurgence in the 1996 exclosure (to the right) – 1994 exclosure to the left, (d) the southern boundary fence of the autumn 1996 exclosure in June 1997 with the rabbit corridor to the left (greenest patches are rabbit middens).

PLATE 2
Appearance of two experimentally sown grasses inside (left) and outside (right) of the 1994 exclosure in August 2002. (a-b) *Sesleria albicans*, (c-d) *Avenula pratensis.*

PLATE 3

Appearance of two experimentally sown forbs inside (left) and outside (right) of the 1994 exclosure in August 2002. (a-b) *Thymus polytrichus;* the small amount of Thyme in (b) is in contact with the 9 cm long knife which is aligned with the original seed drill. (c-d) *Origanum vulgare*; the solitary plant outside the exclosure is to the right of the knife aligned along the seed drill.

PLATE 4

Looking into the 1994 exclosure: (a) through fence B-A (of Fig. 1) on 17 August, 1995; (b) through fence A-D on 12 June 1998 to show that in the near absence of rabbits vegetation outside the exclosure (protected after autumn 1996) had converged with that inside. (b) The seed drills of native *Lotus corniculatus* before the resurgence of a rabbit population outside the fence. (c) Looking eastwards through fence at extreme left of Fig. 1 – rabbit scrapes in relict and contemporary pasture.

previously truncated by rabbits, emerged from their plastic guards.

Some of the herbs sown in 1984, but scarcely contributing to the vegetation cover, became conspicuous within the exclosure by the summer of 1995, and flowered, most for the first time, improving the visual amenity of the site: among these were original clones of *Lotus corniculatus* and rootstocks of *Centaurea nigra* and *Achillea millefolium*; these became luxuriant whilst *Trifolium repens, Plantago lanceolata*, and very rarely *Sanguisorba minor* were found flowering. Complete loss of *Anthyllis vulneraria* and *Leucanthemum vulgare* was confirmed; both were described by Gillham (1955) as non-resistant palatable species.

Immigration of various trees and shrubs became evident through the presence of seedlings. In July 1996 a cursory inspection revealed 26 immigrant species including two potential trees, *Crataegus monogyna* and *Salix caprea*. It is reasonable to assume that removal of the rabbits was leading to a (desirable) local increase in biodiversity.

On the basis of this visual evidence an all-encompassing exclosure was constructed in the summer of 1996; this left 'area Z' (Fig. 1) to the rabbits; part of this area comprised a strip of spoil, *c.* 15 m wide, as the only clear east to west passage for rabbits at the top of the site – a 'rabbit corridor' around 105 m long linking the small areas of relict pasture (labelled in Fig. 1) at either end of the site. Rabbit droppings remained localised into middens on this strip, and were also found scattered (as on rabbit runs through the old grassland nearby): the corridor is illustrated by Plate 1d which also shows part of the new large exclosure with a grassy 'lawn' developed in the first growing-season after rabbit exclusion.

By the late 1990s there was little difference in the appearance of herbaceous vegetation inside and outside the 1994 fence (Plate 4b); the whole site appeared floriferous. However, a few rabbits appear to have remained within the large, 1996, exclosure, where a few dried droppings were occasionally found in the following years. By summer 2002 a resurgence in the number of rabbits within the large exclosure had returned the flourishing vegetation to its previous depauperate state, whilst within the small exclosure the vegetation continued to improve in floriferousness and diversity (Plate 1c). These events complicated experiments, to be described below, but provided insights into the ability of some species first to become established on the spoil from seed, and then to survive despite periods in which they were persistently grazed almost beyond recognition.

Rabbits and The Common Grasses sown in 1984

The two grass species had been sown in 1984 at a rate of 50 kg/ha for *F. rubra* and 25 kg/ha for *A. stolonifera*. No inorganic fertilisers were used, but a small dressing of processed sewage sludge was applied, and in 1990 analysis showed that major soil nutrients were very low (Dixon & Hambler 1993). Pin frame data from a general survey of the vicinity made in June 1990 showed that the two grasses, at that time, provided equal percentage top cover (*F. rubra* 27.8 ± 8.8, *A. stolonifera* 27.6 ± 8.7) with combined values close to 55%; the cover contribution of other species then, and in 1994 was negligible.

Two aspects of the performance of *F. rubra* and *A. stolonifera*, percentage cover and number of inflorescences per unit area, were measured in the summer of consecutive years both inside and outside the exclosures. The first effect of any exclusion of rabbits, however, was an increase in the average length of leaves of both grasses, during the first growing season, to replace the stony aspect with a 'lawn' (cf. Plates 1d and 4a). Within the 1994 exclosure, free of rabbits for two growing seasons, *F. rubra* was producing leaves to a mean maximum length of 13.38 ± 0.58 cm compared with those outside with a mean of 2.67 ± 0.16 cm. Such a vegetative effusion of *F. rubra*, together with a flush of flowering of this grass, and of several forbs, signalled the release of an already extant diverse spoil community from rabbit pressure: the divergent effects of competition on the individual performances of the two grasses were now becoming obvious.

Data were gathered at first from two discontinuous rows of 50 cm – square permanent quadrats, at 1 m centres, parallel to fence B-A of the 1994 exclosure X (see Fig. 1): one

row was 1 m inside the fence, the other was 1 m outside. After the 1996 fence had been constructed a similar row was established outside this (*c.* 30 m to the south) in the 'rabbit corridor'. This corridor, never free of rabbits, gave sub-equal figures for percentage cover of the two grasses during three years of sampling (Fig. 2); this is similar to the 1990 pin frame results and suggests a vegetative inertia with *F. rubra* unable to produce seed, and confined to its original small clonal tussocks by grazing; and with *A. stolonifera* constrained by abiotic stress.

The rows in X and Y were only 2 m apart and it is reasonable to assume that any systematic differences between them before exclosure (see above) would have been negligible. Photographs illustrate typical areas of spoil surface in July 1996 with the narrow leaves of *F. rubra* ascendent inside the exclosure, and the broader leaves of *A. stolonifera* contributing about half of the cover outside (Plate 1a-b).

Visual estimates of percentage cover, with *F. rubra* and *A. stolonifera* distinguished, were made inside and outside the 1994 exclosure each summer from 1996 to 1999 – that is in areas now both free of rabbits; counts of number of inflorescences were also made. In this period *F. rubra* attained cover levels of between 35% and 45% inside and had reached just over 30% outside the fence (Fig. 4); it had thus fulfilled its role as 'stress tolerant competitor' (Grime 1975) and added to the competition increasingly suffered by *A. stolonifera* – a 'ruderal perennial'. Whilst contributing little to cover estimates, *A. stolonifera* when protected from rabbits was increasingly represented by occasional long stolons; its cover was, in 1999, reduced to less than 5% on both sides of the fence (Fig. 3). Equal values for this species inside and outside the 1994 fence in 1998 and 1999 further illustrate a process of convergence which took place once the vegetation in area Y was isolated from rabbits.

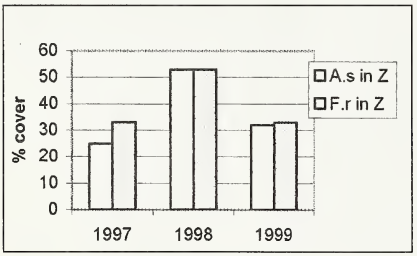

FIGURE 2
Summer percentage cover for *Agrostis stolonifera* (A.s) and *Festuca rubra* (F.r) in part of area Z – the post 1996 'rabbit corridor'.

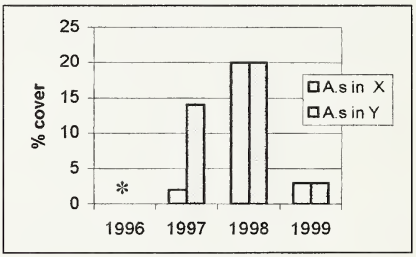

FIGURE 3
Summer percentage cover for *Agrostis stolonifera* in the 1994 exclosure (X) and outside it (Y); * = no data.

The figures representing mean inflorescence numbers per quadrat also illustrate the convergence. This is illustrated graphically (Fig. 5) which shows that after rabbits ceased to suppress its flowering outside the 1994 exclosure, *F. rubra* fluctuated over the subsequent three years with no evident consistency or sign of a trend, until, in 1999, there was parity in the mean number of inflorescences in a 0.25 m 2 quadrat (14.1 ± 4.5 inside and 14.5 ± 4.6 outside the fence). *A. stolonifera* totally protected from rabbits showed a progressive decline in this measure in the 1994 exclosure from 3.7 ± 2.1 to zero between 1996 and 1999. It also suffered a slow decline from a mean of over 35 inflorescences per quadrat in the later-protected area Y until sudden decline to 5.4 ± 1.7 in 1999 which supports the notion of convergence.The figures for inflorescence numbers were very much lower than contemporaneous ones in the 'rabbit corridor', which included a maximum of 308.5 ± 45.0 in (Fig. 6). The sexual reproductive capacity of *A. stolonifera* on this site has been enhanced by rabbits, that of *F. rubra* has been diminished.

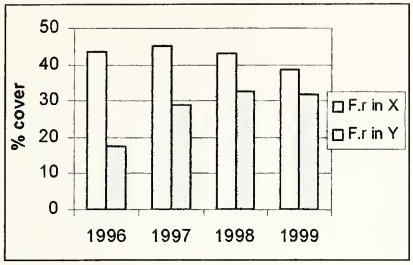

FIGURE 4
Summer percentage cover for *Festuca rubra* in the 1994 exclosure (X) and outside it (Y).

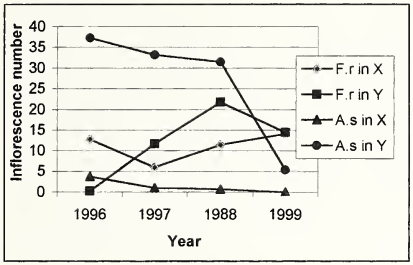

FIGURE 5
Mean inflorescence numbers per unit area inside the 1994 exclosure (X) and outside it (Y) F.r = *Festuca rubra*, A.s. = *Agrostis stolonifera.*

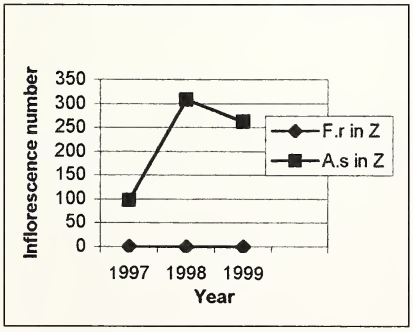

FIGURE 6
Mean inflorescence per unit area of *Festuca rubra* (F.r) and *Agrostis stolonifera* (A.s) in the 'rabbit corridor'(Z).

The number of rabbits patronising an area is almost impossible to ascertain; their general influence includes grazing, trampling, scraping (Plate 4c) and deposition of bodily wastes; and their effect on any one species is conflated with that of all the others. The very great mean inflorescence number per unit area, in 1998 and 1999, for *A. stolonifera* in the 'rabbit corridor' might be related either to an increase in the number of rabbits 'forced' to frequent it (scattering droppings, rather than concentrating them in middens) or even to a decrease in number through its isolation; a sufficient number must have been involved to reduce the flowering of *F. rubra* to near zero. Subjective observations have also suggested that the corridor is becoming generally mossy – a feature characteristic of middens rather than the general surface of the spoil.

Although the presence or absence of rabbits is the final cause of the observed differences, the responses of the two grasses depend on their individual interactions with their total environment. Competition from other species for light, water, nutrients and space must be entirely modified as these species are also relieved of grazing pressure. The two grasses may not be in severe competition in the open dwarfed community, and appear to show similar vegetative responses to some abiotic conditions (possibly year to year climatic variations): both peaked in 1998 in the rabbit corridor (Fig. 2). However, *F. rubra* the taller, more competitive and more stress-tolerant species performed better as the vegetation in each exclosure became increasingly taller and more diverse. Under these conditions neither grass proved capable of rapidly overrunning surface stones, although the stony surface was obscured from view by the sub-erect leaves and culms of *F. rubra.*

Three ecological conclusions, which tally precisely with subjective observations, may be drawn from the numerical results: (a) that *A. stolonifera* performed better both vegetatively and in inflorescence production in the spoil community in the presence of rabbits; (b) that for *F. rubra* the converse was true; (c) that under certain, unmeasurable, states of rabbit patronage,

and in specific locations, the percentage cover values for these species have sometimes devolved to near equality; this equality was over much of the site in 1990 (Hambler *et al.* 1995), and in 1998 and 1999 became evident in a specific area – the 'rabbit corridor'.

All conclusions in field ecology are liable to be more or less site-specific. Here, restoration of wooded grassland on an industrial dump with the use of two grass species long used (see Bradshaw & Chadwick 1980), and other common plants, has proved problematical. Attempts to re-construct 'natural' communities are almost sure to result in failure, but on-site experiments may well decide (a) on the suitablity, or otherwise, of a given species for introduction, and (b) on the desirability of interference with rabbit populations or rabbit access as concluded by Hambler *et al.* (1995).

Ten Species and Rabbit Influence

The seeds of ten herbaceous species were sown in corresponding drills, inside and outside the small exclosure on 5 October 1994. These species are listed in Table 1 together with counts of shoots, clones and infloresences which reflect 'performance' made both before and after October 1996 when the second exclosure fence was completed. Each species behaved in an idiosyncratic manner.

All ten species had germinated by the first autumn after sowing. Only two species, *Lotus corniculatus* and *Gentianella amarella*, had produced flowers by 5 September 1996, and both had done so both in the presence and absence of rabbits. Up to this time it can be seen from the table that rabbits had probably suppressed the performance of most of the species outside the 1994 exclosure: only *Lotus corniculatus* (with too many intermatted shoots and flowers to count), and *Briza media* (with a few more shoots outside than in) provided no clear evidence.

After erection of the second (1996) fence, and before 2000 (when the influence of a resurgent, possibly captive, rabbit population within the large exclosure became manifest) differences in the vegetation inside and outside the first exclosure generally persisted (Table 1) spectacularly so for *Carex flacca* which produced a 14.6-fold preponderance of shoots and even some inflorescences inside the first exclosure in 1998 and 1999. *Gentianella amarella*, whilst probably affected before autumn 1996 by rabbits outside the fence (see also Watt 1981) was lost entirely. With characteristic unpredictability it appeared in 1999, flowering in quantity, and accessible to rabbits nearby.

By 1999 not only *L. corniculatus* but other species including *Thymus polytrichus*, and the three grasses (*Sesleria albicans, Briza media* and *Avenula pratensis*) had produced so many shoots inside the exclosure that counting was impracticable, and of these only *S. albicans* had failed to produce flowers either inside or outside, although it did so in the following year. Soon after the tabulated observations were made signs of a rabbit population, possibly captive, in the zone between the fences (Y in Fig. 1) became noticeable; and by 2002 this zone had reverted to its earlier barren appearance (Plate 1c).

In the summer of 2002 eight of the nine surviving species were fruiting or flowering inside, but not outside the small exclosure; the exception was *Plantago lanceolata* with no flowers on either side of the fence. They thus all fall into Gillham's (1955) 'rabbit resistant' category, and may be expected to survive, albeit dwarfed and sterile, for many years until the rabbits are once more eliminated.

The effects of rabbit grazing on any species in an assemblage of translocated plants may be predictable to some extent from observations made elsewhere, although the difficulty of quantifying rabbit 'patronage' of a site makes this an inexact 'science' as two contrasting examples suggest. In the first example a degree of predictability was possible regarding the fate of *Centaurea nigra*; it was introduced in the original seed mixture in 1984, and was later used as one of the ten experimental species. It was found by Bhradresa (1987) to be preferentially grazed by rabbits in short turf, and Gillham (1955) described it as one of the least resistant plants (in her resistant category), and thus extremely rare on a rabbit-infested rough pasture on a Pembrokeshire island. However, on the spoil it appeared tolerant of

TABLE 1
Performance of ten species sown in October 1994 inside (X)
and outside (Y) a rabbit exclosure.
Note: between October 1996 and around 1998 rabbits were absent outside; thereafter they gradually returned and were very evident by 2002. Numbers refer to plants or shoots (s), flowers or inflorescences (fl). Rabbit activity estimated:
* = none, **= little, *** = much; **** = very much.

	Inside 1994 exclosure (area X) (* no rabbit activity throughout)	Outside 1994 exclosure (area Y) (rabbit activity estimated)	
Avenula pratensis			
17 AUGUST 1995	10s	5s	****
19 JUNE 1996	14s	11s	****
12 JUNE 1998	35s	35s, 8fl	*
15 JULY 1999	Many s, 35fl	Many s, 7fl	*
24 JUNE 2002	Very many s, many fl	± destroyed s. no fl	***
Briza media			
17 AUGUST 1995	20s	10s	****
19 JUNE 1966	49s	14s	****
5 SEPTEMBER 1996	> 17s	20s	***
12 JUNE 1998	>34s, 12fl	35s, 8fl (leaf tips nibbled)	**?
15 JULY 1999	Very many s, 50 fl	Very many s, 60fl	*
24 JUNE 2002	Very many s, very many fl	Grazed to ground surface	***
Carex flacca			
12 APRIL 1996	First seedlings	First seedlings	****
19 JUNE 1998	3s	0s	*
12 JUNE 1998	15s, 1fl	0s	*
15 JULY 1999	117s, 12fl	8s	*
24 JUNE 2002	Very many s, very many fl	Very few s, no fl	***
Centaurea nigra			
17 AUG. 1995	30s	10s	****
15 JULY 1999	15s, no fl	10s, 3fl	*
24 JUNE 2002	Large plants flowering	No plants found	***
Gentianella amarella			
17 AUGUST 1995	20s	15s	****
19 JUNE 1996	43s	16s	****
5 SEPTEMBER 1996	42s, 42fl	16s,12fl	****
12 JUNE 1998	1s, 1fl	1s, 0fl	*
15 JULY 1999	None	None	***
Lotus corniculatus			
17 AUGUST 1995	Many small plants	Many small plants	****
19 JUNE 1966	Many s, 2fl	Many s, 2fl	****
12 JUNE 1998	Mat with many fl	Mat with many fl	*
15 JULY 1999	As above	As above	*
24 JUNE 2002	As above, spreading	Grazed remnants, no fl	***
Origanum vulgare			
17 AUGUST 1995	10s	None	****
19 JUNE 1996	23s	None	****
12 JUNE 1998	46s,	5s	*
15 JULY 1999	>40s, 8fl	5, 0s	*
14 AUGUST 2002	Many, some flg (Plate 3c)	1, no flowers (Plate 3d)	****

	Inside 1994 exclosure (area X) (* no rabbit activity throughout)	Outside 1994 exclosure (area Y) (rabbit activity estimated)	
Plantago lanceolata			
17 AUGUST 1995	50s	None	****
19 JUNE 1996	43s	4s	****
22 AUGUST 1997	?s, no fl	?s, 3fl	*
15 JULY 1999	31s, 12fl	5s, 4fl	*
14 AUGUST 2002	Few	None	***
Sesleria albicans			
17 AUGUST 1995	Seedlings	Seedlings	****
19 JUNE 1996	>25s	20s	****
12 JUNE 1998	Uncountable s	28s	*
15 JULY 1999	As above	15s	*
28 JULY 2000	Fruiting	Fruiting	*
24 JUNE 2002	As above, many fl	?s grazed, 0fl	***
Thymus polytrichus			
17 AUGUST 1995	0s	0s	****
5 SEPTEMBER 1996	8s	0s	****
22 AUGUST 1997	Uncountable s, 1fl	Uncountable s, 3fl	*
24 JUNE 2002	Dense flowering mat (Plate 2a)	Small clumps, 0fl (Plate 2b)	***

grazing: plants which had been maintained as non-flowering, ground-hugging rosettes for a decade became the most conspicuous feature in the 1994 exclosure (the dark capitula are evident in Plates 1c and and 2c): here, lack of resistance did not mean 'surrender'.

In the second example literature sources, reviewed by Pigott (1955), suggest that *Thymus polytrichus* might be expected to perform well in the presence of rabbits; he reported that the species although sometimes nibbled, tends to be avoided, with even the inflorescences escaping damage, and noted that it was one of the few species growing on a Wiltshire rabbit warren. It might, therefore, have been expected to perform nearly as well outside as inside the fence. However fewer plants were found outside in 1996 before the outer fence was constructed; yet in August 1997 *T. polytrichus* was equally luxuriant inside and outside the fence. By 2002 it had spread wide of the seed drill, and was luxuriantly floriferous inside the fence, but was represented outside merely by a discontinuous non-flowering strip along and downhill of the drill (Plate 3 a-b). Pigott also quoted A. S. Watt's observation that *T. polytrichus*, from a condition of abundance, was nearly eliminated (presumably by competition) after six years exclusion of grazing mammals. Our experience has been the converse – the species has, so far, outcompeted others for space in the absence of grazing; and grazing rabbits have devastated *T. polytrichus* and its competitors.

Such observations illustrate a considerable degree of site-specific unpredictability which must be accepted both in the outcome of plant translocation, and in any attempt to restore land to a 'semi-natural' state. They may provide some inspiration for the type of 'gardening' mentioned below.

Discussion: Choice of Plants and 'Gardening'

For ecological rehabilitation of the type of spoil (uncontaminated by any admixture of natural soil) described here, long-term exclusion of rabbits now appears essential. Three native grasses *Sesleria albicans* (Plate 2 a-b), *Briza media* and *Avenula pratensis* (Plate 2 c-d), have been shown to provide possible material for limestone grassland restoration. Although S. *albicans* is slow growing (Dixon 1982) it is able to compete successfully for space with ruderal 'weeds' on a nutrient poor substratum; such adaptive characteristics are precisely what are required. It was shown in our experiment to produce flowers less rapidly than the other grasses. However, it produced bright green dense tussocks (Plate 2a) able to

cover stones, although it was less successful in the presence of rabbits (Plate 2b).

If established, through adequate initial seeding, the sere on unfertilised spoil, with no admixture of topsoil, could (in the absence of rabbits) lead to a Seslerietum (a visually attractive community) in which other calcicoles such as *Primula farinosa* (also introduced, see Hambler & Dixon 2000) might thrive: the last is in fact a constant, as, incidently, are *Briza media* and *Carex flacca* of the *Sesleria albicans – Galium sterneri* grassland (see Rodwell 1993).

As Richardson and Evans (1986) noted, *B. media* and *S. albicans* may be counted among species that are of no agricultural or ornamental value and are therefore not available commercially. As the earliest flowering grass on the limestones of northern England *S. albicans* is certainly 'ornamental' as is *B. media* ("this very beautiful grass" – Hubbard 1984). There might be little difficulty in obtaining 'starter' seed of these grasses and of *A. pratenis* from local wild sources, in order to cultivate a large seed stock for land restoration. Such cultivation might, with foresight, be possible within the precincts of active quarries where seeds will eventually be required, thus allowing material of local provenance to be used.

Among the ten experimental species others well worth sowing for restoration of grassland on any similar spoil are native *Lotus corniculatus* (a nitrogen fixing legume, Plate 4b) and *Thymus polytrichus*, both of which provided good cover and, most importantly, rapidly overran stones on the site. They would be expected to enhance biological diversity: insects visit their flowers and, the larvae of at least twelve lepidopteran species are known to feed on *Thymus* (Pigott 1955). One of these, the Large Blue butterfly (*Maculinea arion*), is not suggested here as an immediate candidate for immigration into North Yorkshire: but with global warming biogeographical stasis cannot exist, and 'invasions' cannot always be predicted. It is interesting to note that Jones and Turkington (1986) listed, in addition to other invertebrates, 142 phytophagous insects occuring on *L. corniculatus* including the larvae of the Common Blue butterfly (*Polyommatus icarus*) and the Six-spot Burnet (*Zygaena filipendulae*); additionally they note that the plant is visited by honey bees and other Hymenoptera.

Centaurea nigra also proved its worth as an insect attractant. The common sedge *Carex flacca* spread and flowered successfully, as did *Origanum vulgare* (Plate 3 c-d): both are suited to dry calcareous sites, although the former also occurs abundantly on damp clayey soil nearby. Two species were shown, for different reasons, to be unreliable: *Plantago lanceolata* which is, in any case, too common to be 'worth the effort', and *Gentianella amarella* – which died out where planted, but later appeared (unassisted) in very local abundance some hundreds of metres away.

The creation *de novo* of a highly diverse living community approximating a 'naturally' evolved one on any site is unfeasible, and the maintenance in perpetuity of any desirable condition attained by artificial means would involve skill, experience and possibly an implausible degree of climatic stasis. However, a technique involving 'offering' a number of desirable plant species for loss or retention by the environmental sieve must be valid; this must be so if for each component species, soil and climate approximate that of *any* of its known habitats. Such approximation applies to all of the species discussed here. Whether or not local provenance is important in habitat creation is open to discussion (see, for example, the contrasting views of Hamilton 2001 and Wilkinson 2001).

Rapid climate change is a reality, and its effects on the habitats of a nationally scarce (but locally frequent), upland calcicole such as *S. albicans* remain unpredictable. Meanwhile, its translocation, described here, involving minimal amounts of seed, to a site which is just outside its known limits of distribution, must be of some conservation value: small natural populations are unlikely to expand, as Lindborg and Ehrlén (2002) have demonstrated, and the species, with its heavy karyopses, has no means of migration across a modern landscape. Should this, and *Primula farinosa* (introduced to the site in 1984, see Hambler & Dixon 2000) be regarded as 'flagship species' for conservation their chances of survival in the long term on a restored site would depend on reactive management of the

vegetation to that end: conservation of a particular vulnerable plant species in any locality, is effectively a form of gardening!

Acknowledgements

Tarmac Northern Ltd. continue to encourage our research, and have generously provided a grant towards printing the colour plates.

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MOAS AT LEEDS

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In 1989 Adrian Norris, the Senior Curator for natural sciences and ethnography in the Leeds City Museum, writing about the Leeds collections stated that "The bird collections comprising some 4500 specimens include ". . . rare and important material, such as specimens of the extinct passenger pigeon and Carolina parakeet, bones of the dodo and several species of moa from New Zealand, as well as many birds now on the endangered list" (Norris 1989).

At the Leeds Museum Resource Centre at Yeadon, near Leeds (the current temporary home of these collections) there are 14 trays, one box and several loose long bones of at least two species of Moa. In addition, there is an articulated skeleton which Alexander (1983) observed has one tarsometatarsus larger than the other, indicating that this skeleton has been assembled from more than one individual. A recent comprehensive account of moa birds, including their discovery, anatomy and evolution, has been published (Worthy & Holdaway 2002). These 'ostrich like' ratite birds, known only from New Zealand, have been extinct for several hundred years. There are thought to have been about 11 species but although a large number are described, the "resulting situation is muddled" (Fuller 2002). The Leeds collections are known to include *Pachyornis elephantopus* Owen 1846, the Stout-legged Moa and *Dinornis giganteus* Owen 1844, the Giant Moa. The identification of other possible species in the Leeds collections is currently under consideration. In the 19th century, many museum curators from around the world were interested in obtaining Moa material for research or display, including Richard Owen who was the first to demonstrate the existence of these large flightless birds. The present account is the story of one curator's successful attempt to do this and explains how the Moa bones came to the Leeds Museum.

When the ship 'Hydaspes' sailed from New Zealand in January 1870, it had in the hold two cases of Moa bones addressed to Henry Denny Esq, Leeds Museum, England. Henry Denny (1803-1871) was a man of "extensive scientific knowledge" (note 1) and an able and valued curator and the collections at Leeds were amongst the best of any provincial society in the country. Denny was General Curator of the Museum and Assistant Secretary of the Leeds Philosophical and Literary Society. He was the first stipendiary curator, having arrived in Leeds in 1826, and served the Museum and Society for 45 years and "Wherever he found missing links in the collections he never rested until he had obtained some object" (Davis 1889). An agent, Miles and Co., had arranged shipment of the bones on behalf of G. H. Moore, estate manager of Glenmark sheep station near Christchurch. Denny had been trying to obtain Moa bones for some time. Writing to Denny in 1868, Moore acknowledged this: "I have not a specimen in my possession at present . . . [but] . . . I will doubtless erelong discover more which I will not fail to forward" (note 2). Following this letter, Moore was busy for six months with his sheep but wrote to Denny again in 1869 saying, "Some tons of the bones have been found while draining a small piece of swampy land close to my residence (note 3). I expect to be draining again in the same locality and shall have pleasure in securing for you all the bones that may be found" (note 4). The men at the station worked hard to dig out the bones while they were digging drains and "any man seen with a straight back in daylight hours was fired for slacking" (Worthy & Holdaway 2002). Later the same year Moore wrote again to Denny: "you will be gratified to learn I have been fortunate enough to find a considerable number of Moa Bird bones . . . [and] . . . I have carefully preserved everyone both whole and broken" (note 5). The Annual Report of the Council of the Leeds Philosophical and Literary Society for 1869/70 records, under donations and additions to the museum: "A collection of valuable bones of the *Moa gigantea*, *Elephantopus*, etc, from Canterbury, New Zealand – Mr G. H. Moore" (note 6). Earlier in the same report the secretary was more specific about the number of species

stating:"a valuable series of bones of at least three species of *Dinornis*, from Canterbury New Zealand, and twenty skins of birds by Mr G. H. Moore, Glenmarck, New Zealand" (note 7).

Moore had also been collecting for Julius Haast (1822-1887), later Sir Julius von Haast, the recently appointed (1869) Curator of Canterbury's Museum in Christchurch (note 8). Moore had made this clear in a letter to Denny: "Dr Haast our Geologist has had many specimens from me, several of which are set up in our Christchurch museum" (note 9). Unlike some curators, such as Frederick McCoy at Melbourne, who were able to purchase most of the specimens for their museums, Haast had to rely on exchanges with other museums round the world. The German-born Haast became an authority on Moa birds (note 10) and his "dynamic leadership and untiring energy" (Sheets-Pyenson 1988) meant that the establishment and early development of this museum was largely due to him. Building up the collections by exchanging duplicates meant that "Moas were prize objects for bartering purposes" (Sheets-Pyenson 1988). According to Worthy and Holdaway (2002), the skeletons were sent to "sites worldwide in exchange for specimens to fill Haast's new Canterbury museum". Moore however became suspicious and unhappy about the way in which Haast was dealing with the Moa bones the former had provided. He wrote to Denny: "I feel annoyed to learn that Dr Haast has been making a trade with the bones I gave him. Understood him to say that they would be distributed to museums in other parts of the world in Exchange for what might be acceptable to our Canterbury museum" (note 11). According to Sheets-Pyenson (1988), Moa skeletons about this time "fetched £20 to £40 depending upon their size, age, quality and completeness". Moore wrote to Denny again in February 1870, to confirm that the cases were on their way to Leeds, adding "you have all that I got . . . I am very much obliged to you for your kind offer to contribute to our museum" (note 12).

On 26 May 1870, the Secretary of the Leeds Philosophical and Literary Society wrote to Moore to let him know of the safe arrival of the long expected bones and later that year Moore wrote to Denny wishing "that the variety had been more complete" but hoping that "when I trench deeper of getting the greater part of what . . . are deficient" (note 13).

As a result of his efforts and in appreciation of his help, Moore was awarded Honorary Membership of the Leeds Philosophical and Literary Society in 1871. His name appears in the Annual Report alongside such well-known scientists as Louis Agassiz, Robert Grant, Richard Owen, John Phillips and Adam Sedgwick.

Denny also approached James Hector (1834-1907). Hector (note 14), later knighted and one of the most important scientists in New Zealand in the second half of the 19th century, was born and educated in Edinburgh, where he was awarded an MD by its University in 1856. There he had made a special study of Moas. In 1866 he became Director of the Meteorological Weather Department and of the Colonial Museum and Botanical Gardens at Wellington and in the same year a Fellow of the Royal Society. Hector, writing to Denny in 1870 (note 15), stated "I have already sent you a box of Moa bones . . . Skulls are very difficult to get", adding "I don't like parting with the old bones". This consignment arrived in London in April, and on 29 April 1870 the bones were forwarded by rail to Denny at Leeds. The Annual Report (note 16) records "Bones of a species of Moa, from Wellington, New Zealand – Dr Hector FRS, Wellington, New Zealand". Hector was forming collections for his own museum and asked if, in exchange, Denny could send a sample of coals, rocks and fossils.

Unlike the exchanges of native birds' eggs, skins and skeletons taking place between Canterbury Museum and other museums around the world in the 1870s and 1880s (Burrage 2001), the material from Glenmark swamp appears to have been sent directly from Moore to Denny, rather than from the museum curator Haast. Although Moore was in close touch with Haast and provided the latter with Moa bones, Haast does not appear to have been directly involved in this instance, although he did provide 20 bird skins as a gift to the Leeds museum to be sent with the Moa bones. Although it is known that Moa bones were exchanged worldwide, no mention of these is made by Burrage (2001) in her list of native

bird skeletons, a list taken from the museum exchange books dating from 1869 to 1913. In the light of Moore's comments about Haast's "trade" in Moa bones, perhaps most of them were sold and therefore not recorded in the exchange books. In the case of Leeds, although Denny made offers of help to the Canterbury Museum via Moore, it is not know whether exchanges took place between the two museums.

Acknolwedgements

I am particularly grateful to Adrian Norris for allowing access to the database, collections and archives at the Leeds Museum Resource Centre. I am also pleased to acknowledge the as istance of Paul Scofield from the Canterbury Museum, Christchurch and Susan Superville from Te Papa Tongarewa Museum, Wellington, New Zealand.

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Notes

1. The Fifty-first Report of the Council of the Leeds Philosophical and Literary Society 1871. Leeds: 6.
2. Moore to Denny 6/7/1868.
3. The Glenmark swamp deposit, about 50 miles north of Christchurch, had been discovered in 1866 and was excavated during the next few years. By 1868 the site provided enough material for exchanges with foreign museums.
4. Moore to Denny 23/2/1869.
5. Moore to Denny 1/9/1869.
6. The Fiftieth Report of the Council of the Leeds Philosophical and Literary Society (read at the Annual Meeting of 4 May 1870 and known as *The Annual Report*) 1870: 29.
7. At the same time as the moa bones were sent by Moore, an additional case of 20 skins of New Zealand birds were sent, the gift of Julius Haast to Denny. Haast's hand-written list is in the archives at the Leeds Museum Resource Centre.
8. In 1875 Johann Franz Julius Haast (1822-1887), the first Director of the Museum, received an Austrian knighthood, becoming von Haast, and a British knighthood in 1886.
9. Moore to Denny 23/2/1869.
10. Haast had assembled and set up skeletons of the Moas at the Christchurch Museum which had been "selected from not less than two tons weight of bones" (Moore to Denny 1/9/70).
11. Moore to Denny 1/9/1869.
12. Moore to Denny 17/2/1870.
13. Moore to Denny 1/9/1870; this letter refers to a "head" sent earlier – "It was the only one I found".

14. Sir James Hector was born on 16 March 1834 and died on 5 November 1907. Edward Forbes (1815-1854) had taught him natural history at Edinburgh and "his lectures deeply interested Hector" (*Dictionary of National Biography*, 2nd suppl. 1912, **2**: 236). Hector eventually established a worldwide reputation as a geologist and naturalist and is described as "the most influential of the first generation of resident New Zealand scientists" (Worthy & Holdaway, 2002).
15. Hector to Denny 11/3/70.
16. See note 6 – Annual Report of the Council of the Leeds Philosophical and Literary Society 1870: 29.

BOOK REVIEW

Linnaeus. The Compleat Naturalist by **Wilfrid Blunt**, with an introduction by **William T. Stearn**. Pp. 264, with numerous illustrations. Princeton University Press, Princeton & Oxford. 2002. $35.00 hardback.

Carl Linnaeus (1707-1778), the creator of the binomial system for the naming of plants and animals, needs no introduction and of the large number of works published on him, that published in 1971 by Wilfrid Blunt (who died in 1987) under the title *The Compleat Naturalist: A Life of Linnaeus* made an enormous impression and generated a worldwide readership. It is a pleasure to see it in print once more, and every effort has been made by the publishers to make it just as attractive as its predecessor.

Wilfrid Blunt drew on all his skills as a foremost author of books on European art and botany to provide us with a most readable and authoritative biography of the man dubbed the "Divine Naturalist" on account of his belief that "he was chosen by God to resolve the jumbled classification of the natural world". His biography charts the rise of Linnaeus from a poor student at Lund University to Professor of Medicine at Uppsala and a founder member (and first President) of the Royal Academy of Science in Sweden (the Swedish counterpart of the Royal Society of London). Of particular interest are Linnaeus's travels, his publications and his development of binomial nomenclature, all of which are vividly portrayed in words and illustrations. The closing chapter deals with the Linnaean Collections, the sale of which to Britain in 1784 was an embarrassment to Sweden; James Smith, on the advice of Sir Joseph Banks, was urged to make a bid. Upon the death of Smith, these priceless collections came to the Linnean Society of London (founded in 1788).

The text is complemented throughout by lavish illustrations and supported by a chronology, bibliography and index, as well as an introduction by the distinguished botanist and former President of the Linnean Society, William Stern, and two appendices, on 'Linnaean classification, nomenclature and method' (also by Stern) and on 'Systematics and taxonomy in modern biology' (by C. J. Humphreys).

MRDS

ENTOMOLOGICAL REPORT 1998-2001
HYMENOPTERA: SYMPHYTA

J. D. Coldwell

The following list comprises some of the more uncommon sawflies recorded in Yorkshire during the period indicated.

Thanks are due to Dennis Giggal (DG) and Chris Hopkinson (CH) for passing on specimens and to Dr Richard Smith of Sheffield University, co-ordinator of the 'B.U.G.S.' survey (the aim of which is to assess biodiversity in gardens around Sheffield) who supplied me with specimens, mainly malaise-trap material, from the survey carried out in 2000. All other records are my own unless otherwise indicated.

The usual symbols are used to denote new county (†) and vice-county (*) records.

Xyela julii (Brebisson)	(*63) Little Don Valley, 9.v.98.
Abia candens Konow	(*63) Dovecliffe, Barnsley, 1998: CH. Very scarce with few Yorkshire records.
Trichiosoma vitellinae (L.)	Breary Marsh, Leeds, 14.vii.99. Perhaps not as rare as once thought.
Heptamelus ochroleucus (Stephens)	(*64) Breary Marsh, 14.vii.99. (*63) Little Don Valley, 28.vii.99. Cliff Wood, Langsett, 12.viii.00. A local but presumably overlooked bracken feeder.
Aneugmenus furstenbergensis (Konow)	(*63) Wombwell Wood, 5.vi.00. On bracken, very local.
Dolerus megapterus Cameron	Rare in England. A small population present in the Little Don Valley, 1998-2000. Only previously in Yorkshire from Wilthorpe Marsh in 1988.
Athalia cornubiae Benson	A number of specimens from gardens in the Sheffield area SK3184, 3185, 3284 during the 2000 'B.U.G.S.' survey. Otherwise only from Rockley in 1980 and Keld Head in 1982.
Empria pumila (Konow)	(*63) One specimen from a Sheffield garden SK4485 in 2000. Scarce, with few Yorkshire records.
Periclista albida (Klug)	Hemingfield, 5.v.99. 2nd county record.
†*Periclista lineolata* (Klug)	Wilthorpe Marsh, 3.v.99.
Fenella nigrita Westwood	(*63) Dovecliffe, Barnsley, v.99. DG. One adult of this minute black species. Normally detected as leaf mines, but rarely reported in Yorkshire in either case.
Hemichroa crocea (Geoffroy in Fourcroy)	(*63) Wilthorpe Marsh, 1998, DG. Very scarce in the county.

Pristiphora conicep Lindqvist	Gypsy Marsh, 1.vii.98. Only previously in Yorkshire from the nearby destoryed Manvers site.
Pristiphora fu..pes (Fallen)	(*63) Gypsy Marsh, 18.viii.00. Sheffield, vi.00. (B.U.G.S. survey).
*Pristiphora mollis (*Hartig)	(*63) Little Don Valley, 16.v.98.
†*Amauronematus mundus* Konow	Gypsy Marsh, 15.iv.97.
†*Amauronematus fasciatus* Konow	Tom Royd Wood, Silkstone, 18.vi.01.
Amauronematus viduatus (Zaddach)	(*63) Gypsy Marsh, 21.iv.00.
Nematus capreae (Thomson)	Little Don Valley, 5.viii.00. First record for many years.

BOOK REVIEW

The New Forest by **Colin R. Tubbs.** Pp. 400, with 20 colour plates, b/w photographs, maps and tables. New Forest Ninth Centenary Trust, High Street, Lyndhurst SO43 7NY. £35 hardback, 320 softback (including p&p).

This book is essentially a second edition of the Collins' New Naturalist title by the same author (1986), the Nature Conservancy Council Regional Officer for Hampshire and the Isle of Wight for 33 years, who lived and worked in the Lyndhurst area for more of his life until his untimely death in 1997. The work celebrates his leadership in wildlife conservation of the area during that time.

The first six chapters provide a backcloth, history and perspective of the New Forest we know today. Chapter 5 outlines the history of its formation between 1066-1086 to its establishment as a deer forest, with references to the numerous medieval documents which governed life in the forest. From Chapter 7 onwards the author reviews the face of the Forest in the late 20th century, outlining the pastoral economy and its effect on the landscape. A later chapter details the role of large herbivores, backed-up with numerous statistics and providing detailed explanations of the different effects of horses, sheep, cattle and deer grazing on the resultant vegetation. There are three chapters on the ancient woodland, with scathing criticism of the management regime proposed by the Forestry Commission. By now the reader will have gathered that the author was not a 9 to 5 desk-bound administrator but an eminent field naturalist, specialising in the higher animals, who meticulously recorded his observations.

I found the chapters on the Heath, Mire and Grassland a little disappointing. Each of the plant communities present is listed but there is no reference to the National Vegetation Classification system, which had been trialled by the Nature Conservancy for some years before the author's retirement. I was disappointed to find on p. 242 a reference to some work undertaken by a namesake of mine only to find that in the list of references the work was not listed. However, the author died before publication and it is a tribute to his wife and field companion Jenni that the book was published at all. The Heathland fauna is well covered and again provides evidence of the author's devotion when he reveals the pattern and numbers of Buzzard nesting sites over 25 years. The closing chapters discuss the waterside habitats of the area and outline a future vision for the designated New Forest National Park. For those charged with managing similar heath, mire and woodland communities, this book is essential reading.

JAN

THE HOODED SEAL *CYSTOPHORA CRISTATA* (ERXLEBEN, 1777), A NEW MAMMAL FOR THE YORKSHIRE COAST

C. I. MASSEY
4 Whin Bank, Scarborough YO12 5LE
AND
C. A. HOWES
Museum and Art Gallery, Chequer Road, Doncaster DN1 2AE

On 22 September 1999 an exhausted juvenile female Hooded Seal (*Cystophora cristata* Erxleben) weighing 45 kg came ashore at the West Pier slipway, Scarborough (TA/048886) and was taken into care by the Scarborough Sea Life Centre (*Scarborough Evening News*, 23.9.1999; *Yorkshire Post,* 23.9.1999) but died shortly after. Curiously, on dissection its gut was found to contain a number of plastic spoons (Scarborough Sea Life Centre *pers. comm.*). The Scarborough specimen constituted the first Yorkshire, fourth English and fourteenth British record.

The hooded seal is a relatively solitary pelagic species of the north Atlantic, normally confined to regions of pack ice and ice-flows in high arctic waters, shunning the circulating system of the Gulf Stream (King 1964, Macdonald & Barrett 2001).

In February and March they assemble in two widely separated breeding areas. The less numerous western populations gathers off Newfoundland and Nova Scotia and in the Gulph of St Lawrence and the Davis Straight. The main eastern population gathers off Jan-Mayan Island to the north-east of Iceland. Within these breeding areas they form into small, scattered groups on thick old ice-flows far from land (King 1964, Sergent 1979).

Pups are borne from mid-March to mid-April and appear in characteristic 'blueback' pelage, slate-blue above with a contrasting cream ventral surface. They are remarkably precocious, being able to swim and dive a few days after birth. The lactation period of between 3 to 5 days, the shortest known for any mammal, is thought to be an adaptive feature of seals that breed on unstable pack ice (Macdonald & Barrett 2001).

Adults undertake long migratory movements to assemble at moulting areas where they remain from mid-June to mid-July. The western population moving up to Cape York and the Lancaster Sound to the west of Greenland and the eastern population gathering in the Denmark Straight to the east of Greenland (King 1964, Macdonald & Barrett 2001).

Hooded seals feed on deep water prey including Redfish (*Sebastes marinus*), Arctic cod (*Boreogadua saida*) and squid (e.g. *Gonatus fabricii*), and from the sea bed, Greenland halibut (*Reinhardtius hippoglossoides*), starfish and mussels (Seargent 1979, Macdonald & Barrett 2001).

Polar bear (*Ursus maritimus*) is thought to be a significant predator at the whelping areas and Greenland shark (*Somniosus microcephalus*) at the moulting grounds.

The first recorded occurrence in British waters evidently dates from 1577 (Anderson 1990) and up to 1964 there had been only seven records, two Irish, three Scottish and two English. Those recorded in English waters were one in the river Orwell, Suffolk 29 June 1847 and another in the Mersey in 1873 (King 1964). By 1990, with additional Scottish records, the British total had risen to 11 (Anderson 1990).

Up to the 1960s individuals occurred as extremely rare vagrants down the European coastline as far south as the Bay of Biscay and down the American east coast as far south as Florida.

A recent spate of hooded seal pups occurring far south of their traditional distributional range could be related to failures in food stocks in arctic waters or changes in the circulation of arctic currents. In 2001 alone, over 33 young hooded seals had strayed or stranded south of their range on both sides of the North Atlantic, most occurring during the period from July to September (Caribbean Standing Network 2002, web page).

Whatever the reason for this phenomenon, the 1999 Scarborough specimen would seem to be part of this recent trend. Other British and European examples to hand are as follows:

In mid-October 1995 a female pup was found stranded on Treyarnon Cove Beach near Padstow, Cornwall (SW/8574) during the week prior to 26 October. It was taken to a seal sanctuary prior to being transported back to arctic waters (*Truro Packet*, 26.10.1995).

In September 1999 a sick and exhausted female pup was found in the Orkney Islands, only the third of its species to have been recorded on the islands. It was taken to the Orkney Seal Rescue Centre but died a few days later (Seal Conservation Society 2002 website; *BBC News,* 23.11.2001).

On 29 July 2001 a pup was washed ashore at Little Haven Beach, Pembrokeshire (SR/81), the first record for Wales, it was taken to a seal hospital at Milford Haven (Seal Conservation Society, 2002 website; *BBC News*, 23.11.2001).

On 22 August 2001 a young female was found in shallows at Malaga on Spain's Costa del Sol and taken into care at a local Turtle rescue centre. After being transferred to the seal sanctuary at Gweek, Cornwall, where it attained a weight of 50 kg, it was transported to Scotland on 17 December to be released on Orkney in the hope it would continue on to arctic waters (*BBC News,* 23.11.2001; *Helston News,* 17.8.2001).

In mid-September 2001 a male weighting 30 kg was found beached at Morriscastle, Co. Wexford, Republic of Ireland. It was released in November 140 miles off the Galway coast (Irish Seal Sanctuary, 2002, website).

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BOOK REVIEWS

Darwin's Mentor. John Stevens Henslow 1796-1861 by **S. M. Walters** and **E. A. Stow.** Pp. xx + 338 incl. b/w frontispiece and numerous illustrations, plus 8 pp colour plates. 2001. Cambridge University Press, Cambridge. £40.00 hardback.

The question to be addressed is "Would a biography of Henslow have been worthy in its own right rather than falling under the banner of Darwin?". Are the authors and publishers marketing Henslow's biography mainly on the strength of his association with Darwin? It would appear that outside of Cambridge, Henslow is known only as Darwin's teacher, but since he was responsible for capturing his attention and awakening his life-long enthusiasm for natural history, it is clear that he had both charisma and standing and the authors are to be congratulated on a most readable and scholastic biography of this remarkable character.

Not only did Henslow exert a major influence on Darwin's thoughts and insights, as he did for countless others, but he was also responsible for the establishment of 'institutions' that live to this day, being, for example, the vision behind the new Cambridge Botanic Garden and a co-founder of the Cambridge Philosophical Society.

The authors unfold a fascinating story of Henslow, from his childhood, being born into comfortable circumstances and showing a strong aptitude for natural history, through his education at Cambridge, and his subsequent scientific and clerical career. At Cambridge, he

was appointed Professor of Mineralogy at the tender age of 26, taking over the Professorship of Botany three years later. As the latter, he took a broad approach to the subject, his lectures attracting large audiences and his practical classes and field excursions having a similar impact. He recognized the value of the herbarium, and spent much time reorganizing and expanding its collections. He was responsible for the purchase of land for a New Botantic Garden in 1831, which, after lengthy legal disputes with a sitting tenant, finally opened in 1846. Darwin attended Henslow's lectures in 1829, 1830 and 1831, and it was Henslow who recommended him as a naturalist for the 'Beagle' voyage, suggesting that he took with him a copy of Lyell's *Principles of Geology*, a work which had a profound effect on his thinking. Rather interestingly, although Henslow recommended Lyell's book to Darwin, he did not "accept the views therein advocated" and, in later years, Darwin was unable to convert his old teacher to his evolutionary views.

After 1837, as Rector of Hitcham, Henslow's clerical duties allowed him time for less than five weeks a year to fulfil his lecturing role as a Cambridge professor. Since there was great poverty in Hitcham, and Suffolk as a whole, he made strenuous efforts to alleviate this by initiating a wide range of educational and recreational opportunities. As a consequence he was unable to continue to pursue his botanical interests both locally and at Cambridge, as exemplified by a letter he wrote in 1846 in response to a friend asking him for his help in writing the *History of Botany:* "I fear (indeed I know) that I am not so well qualified as I ought to be to speak authoritatively on these matters . . . When I came to Hitcham I had fancied that I should have more opportunity than ever to devote my time to Botany – but I well remember a remark of Willis 'you will get entangled in other interests and less able to pay attention to your Professorship' and so it has proved".

Much criticism has been levelled at Henslow in the past, mainly on the basis of his being an absentee professor, but the authors reveal other sides to his life. Although his scientific achievements were modest, he undoubtedly had a major influence on the history of botany at Cambridge (the continuation of which was sorely needed when he moved to Hitcham). In addition, he was a champion of liberal and Christian principles, and in the words of his biographers "an admirable man".

The publishers are to be commended for such a lavish production, richly complemented by beautiful illustrations (save for the rather amateurish pencil drawings which precede each of the three sections); this and the sympathetic and scholastic text should attract a wide readership. Strongly recommended.

MRDS

Keys to the Freshwater Microturbellarians of Britain and Ireland, with notes on their ecology by **J. O. Young.** Pp. 142, incl. 70 line drawings. Freshwater Biological Association, Ambleside, 2001. £16 paperback.

When, more than 50 years ago, I became interested in freshwater flatworms, I would have welcomed this publication on microturbellarians. I was at the time helped by a pioneer guide to British triclads by Henry Whitehead published in the *Essex Naturalist* (1922), now superseded by three successive editions of the excellent FBA *Scientific Publication* on triclads by Reynoldson and, latterly, by Reynoldson and Young. To the more speciose microturbellarians I would have had almost no guide had not the same Henry Whitehead (a pioneer freshwater ecologist and sometime President of the Yorkshire Naturalists' Union) generously given me three large, still treasured, exercise books in which he had made hand-written translations of much of the text, and copies of the figures, of von Graff's work on rhabdocoels in the *Süsswasserfauna Deutschlands* (1909), and notes from other German works. These still remind me of his kindness and encouragement. Now J. O. Young has produced a key to the 55 species of microturbellarians (the Preface, not by the author, says 56) so far recorded in Britain. These, all formerly called rhabdocoels, are, though not by universal assent allocated to several orders.

These soft-bodied animals can best be identified when alive – an advantage to the naturalist – but their shapes are not rigid and their illustration presents difficulties. Happily they often differ much inform, and the illustrations in this work should be a good guide to identity. The keys, tested only in the mind, promise to be effective, but to be told that light reflecting organs, and eyes, may be "present or absent" doesn't really help, and in three places they depart, rather confusingly, from strict dichotomy.

Like other recent "keys" in this series, this is in fact a mini-monograph (271 references). Much information, not confined to British, or even European, species, is given on feeding, ecology, reproduction, life cycles and other matters, sometimes as a dense catalogue of facts. A statement about food is supported by 37 references that occupy eight lines of text, and a sentence on habitats by 28 references! These, however, are often far from specific. Seven pages deal with distribution and abundance, with things that affect such, and with assemblages of species but, save for a list of those found in moderately deep water, hardly any species is mentioned by name (three pages include not a single name), so these sections are less useful than they might have been. Having identified one's animal one would like to know how common or rare it is in Britain, where it has been found, and something about its ecology and habitat preferences, but no such information is given, which is disappointing to the user.

Microturbellarians would provide a fascinating study for the amateur naturalist. Much remains to be discovered. This welcome publication will help the aspiring investigator. However, most users, be they students or amateur naturalists, will probably have little previous knowledge of these animals and will be concerned initially with identifying their finds (a need that this series of publications was designed to meet). Having done so, they will expect to be told something about the species concerned. Only then will a few of them delve hopefully into the repository of information, and even fewer will pursue the references, compiled by the knowledgeable author of this work on what, in the British context, is a little studied group of animals.

GF

The Pennines and Adjacent Areas by **N. Aitkenhead et at.** Pp. x + 203 incl. numerous coloured illustrations, plus a fold-out map. 2002. 4th edition. British Geological Survey, Keyworth, Nottingham NG12 5GG. £18.00 paperback. (Online shop: www.eologyshop.com)

Since an understanding of the geology of a region is fundamental to a true appreciation of the landscape, Yorkshire naturalists' are strongly recommended to purchase this work as its coverage embraces a large proportion of their county. Sections dealing with the different geological strata include treatments of specific rock types such as those found in Ingleton, Askrigg, Craven and Wensleydale, as well as detailed interpretations of the very wide range of geological periods and processes found in our region. The section on "geology and man" is of environmental interest and includes such topics as fuel and energy, industrial and metalliferous mineral resources, hydrogeology and geological hazards, as well as information on building stones (including those encountered in Bradford, Leeds and Sheffield). The whole is copiously illustrated with coloured photographs (including many key sites in Yorkshire), maps and tables which provide a clear and comprehensive account of our geology for students, amateurs and professionals.

MRDS

IRISH NATURALISTS' JOURNAL

The *Irish Naturalists' Journal,* sucessor to the *Irish Naturalist,* commenced publication in 1925. The quarterly issues publish papers on all aspects of Irish natural history, including botany, ecology, geography, geology and zoology. The *Journal* also publishes distribution records, principally for cetaceans, fish, insects and plants, together with short notes and book reviews.

Current subscription rates for four issues (including postage): 25.00 (£15.00 stg); Students 8.00 (£5.00 stg). Further details from: Mr Brian Nelson, INJ, Department of Zoology, Ulster Meseum, Botanic Gardens, Belfast BT9 5AB.

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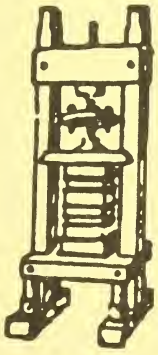

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April-June 2003

Number 1045
Volume 128

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Lichen Herbarium at the Manchester Museum: 1. Collectors – *M. R. D. Seaward*

The Wasps and Bees (*Hymenoptera: Aculeata*) of Remnant Sites in Intensive Agricultural Countryside in Watsonian Yorkshire: Brayton Barff, Ringhay Wood, South Cliffe Common and Thornton Ellers – *Michael E. Archer*

Entomological Report: Diptera (Tipuloidea and Empidoidea) – *Roy Crossley*

The Distribution of the Small Pearl-Bordered Fritillary Butterfly *Boloria Selene*, in Yorkshire VC65 – *Terence M. Whitaker*

Obituary – Athol Johnston Wallis (1919-2002)

Entomological Reports 2000-2002 Coleoptera: Staphylinidae (Aleocharinae) – *M. L. Denton*

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record his deep appreciation of this imaginative gesture.

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LICHEN HERBARIUM AT THE MANCHESTER MUSEUM: 1. COLLECTORS

M. R. D. SEAWARD
Department of Environmental Science, University of Bradford, Bradford BD7 1DP

Although several researchers have used the contents of the Lichen Herbarium at The Manchester Museum (MANCH) over recent decades for county floras and monographs (e.g. Watson, 1946; Hawksworth 1972), a detailed analysis of the contents has not been undertaken. The considerable work done by the late Professor Brian Fox on the reorganisation of the main collection has been continued by the present author over the past 18 months, and additional material from various sources has been added. During the course of this work, some material has been reidentified, and/or repacketed and conserved.

The Herbarium is divided into two Collections: (a) British and Irish with 7540 packets and (b) Foreign with 4031 packets. There is also a bound volume of bryophytes, lichens and algae assembled (but not all necessarily collected) by Dr [? E. or W.] Hobson, a few of which are localised and dated from Cheshire, Yorkshire (1854, 1856, 1857), Forfar (1840), Co. Cork and Co. Dublin.

The British and Irish Collection contains material from: Avon, Berks., Bucks., Cheshire, Cornwall, Cumbs., Derbyshire, Devon, Dorset, Durham, Essex, Glos., Hants., Hereford, Herts., Hunts., Isle of Man, Isle of Wight, Kent, Lancs., Leics., Lincs., Middlesex, Northants., Northumbs., Notts., Oxfordshire, Rutland, Scilly Isles, Shropshire, Somerset, Staffs., Suffolk, Surrey, Sussex, Westmorland, Wilts., Worcs., Yorkshire, Anglesey, Caerns., Cards., Denbigh, Flint, Merioneth, Pembs., Skokholm; Aberdeenshire, Forfar (Angus), Argyll, Arran, Ayrshire, Banff, Caithness, Coll, Dumbarton, Dundee, Fife, Inverness, Kincardine, Kintyre, Kirkudbright, Orkneys, Outer Hebrides, Perthshire, Renfrew, Ross, Shetlands, Skye, Sutherland, Tiree, Wigtown, Co. Antrim, Co. Down, Co. Clare, Co. Cork, Co. Dublin, Co. Kerry, Co. Limerick, Co. Tipperary, Co. Wicklow and the Channel Islands (Alderney, Guernsey, Jersey, Sark).

The Foreign Collection contains material from: Algeria, Australia (incl. Tasmania), Austria, Belgium, Bolivia, Brazil, Canada, Canary Islands, Chagos Archipelago, Chile, Colombia, Czech Republic (Bohemia), East Indies, Ecuador, Falkland Islands, Fiji, France, Germany, Greece, Greenland, Himalayas, Hungary, Iceland, Indonesia, Jamaica, Madagascar, Mauritius, Mexico, Nepal, Norway, Poland, St Helena, Seychelles (incl. Aldabra), South Africa (incl. Cape of Good Hope), Sri Lanka (Ceylon), Sweden, Switzerland, Tunisia, Uruguay and USA.

Accounts of the more interesting items in these collections currently being investigated by Dr B. J. Coppins and the author will be published in due course.

Biographical information on the collectors has been gleaned from many sources, more particularly Desmond (1994), Franks (1973), Harrison (1985), Hawksworth and Seaward (1977), and Kent and Allen (1984), but as can be seen from the following lists, certain data are lacking for numerous collectors; the author would be interested to hear from those able to supply such data. In the following lists of collectors, several are additional to those enumerated in Franks (1973). Major collectors are prefixed by an asterisk (*).

Those wishing to view or work on these collections should contact: Dr S. R. Edwards, Keeper of Botany, The Manchester Museum, Oxford Road, Manchester M13 9PL (e-mail: sean.edwards@man.ac.uk; website: www.museum.man.ac.uk/home/index.htm)

British and Irish Collectors

Agnew, A. D. Q. – Caerns. 1955
Alvin, K. L. (1927-2001) – Dorset 1956
Bailey, C. (1838-1924) – Cornwall 1866, 1886, 1909; ? Derbyshire 1862; Notts. 1871; Yorks. 1884

Bainbridge [details unknown] – Yorks. 1878, 1879
Baker, J. G. (1834-1920) – Yorks. 1856, 1867
Balfour, J. H. (1808-1884) – Aberdeenshire 1837, ?1847
Barfoot, W. [details unknown] – Hants. 1898 [ex herb. Mott]
Barker [details unknown] – Worcs. 1834 [ex herb. Gray]
Besterman, P. – Argyll 1995
Bishop (Mrs) [details unknown] – Jersey 1872 [ex herb. Mott]
Bloxam, A. (1801-1878) – Derbyshire; Isle of Wight; Leics. [all undated]
* Bohler, J. (1797-1872) – Cheshire; ? Cumbs.; Derbyshire; Isle of Man; Lancs.; Leics.; Notts.; Staffs.; Westmorland; Worcs.; Yorks.; Caerns. [all undated; most with handwriting of Windsor & ex herb. Windsor]; Co. Cork; Co. Dublin; Co. Wicklow [probably leg. Mackay, det. Bohler]
* Borrer, W. (1781-1862) – see under Spruce
Bower, F. O. (1855-1948) – Merioneth 1886
* Bowman, J. E. (1785-1841) – Cheshire *c.*1830; Derbyshire 1830; Anglesey 1830; Denbigh *c.*1830; Flintshire *c.*1830; Merioneth 1833
Brabazon (Miss) [details unknown] – Co. Meath n.d.
Brash, T. – Ross & Cromarty 1994
Brown, R. (1773-1858) – Angus 1792
Burton, J.W. [details unknown] – Cheshire 1876
* Carrington, B. (1827-1893) – Lincs. n.d.; Yorks. 1847, 1850, 1855, 1857, 1858; some or all of the following may be ex Carrington: Shropshire n.d.; Caerns. 1871; Aberdeenshire n.d.; Forfar n.d.; Perthshire 1856, 1877; Co. Cork 1869; Co. Kerry 1861
* Carroll, I. (1828-1880) – Perthshire 1864; Co. Clare 1865; Co. Cork n.d.; Co. Galway 1865; Co. Kerry 1864; Co. Limerick 1865; Co. Tipperary 1865; also many specimens, probably leg. Carroll, from Co. Kerry (mainly Muckross) 1867 in Hardy's handwriting
Chambers, R. – Anglesey 1994; Denbigh 1994
Chandler, T. [details unknown] – Co. Cork n.d.
Cohen, E. [details unknown] – Merioneth 1935
Coppins, B. J. – Tiree 1983
Crespigny, E. C. de (1821-1895) – Bucks.; Kent; Middlesex; Surrey [all undated]
Croall, A. (1809-1885) – Forfar 1838,1852
* Crombie, J. M. (1830-1906) – Berks.; Devon; Essex; Hants.; Herts.; Isle of Wight; Kent; Middlesex; Surrey; Sussex; Warwicks.; Aberdeenshire; Argyll; Inverness; Kincardineshire; Mull; Perthshire; Renfrew; Stirling; Guernsey; Sark [all undated]
Curnow, W. (*c.*1809-1887) – Cornwall *c.*1874; Scilly n.d.
Dickson, J. (1738-1822) – Surrey n.d.
* Dixon, G. (1812-1904) – Durham 1853; Yorks. 1852-1855
Don, G. (1764-1814) – see under Simmonds
Drew, K. M. (1901-1957) [also as Wright-Baker, Mrs K. M.] – Cheshire 1934, 1936; Derbyshire 1938; Devon 1937; Durham 1936; Merioneth 1931; Inverness 1935; Perthshire 1935; Sark 1925
Duncan, U. K. (1910-1985) – Angus 1980
* Edwards, S. R. – Cornwall 2000, 2001; Derbyshire 1992-1994; Devon 2000; Hants. 1991; Lancs. 1991-1993; Surrey 1988, 1991, 1992; Sussex 1990, 1997; Anglesey 1987
* Fox, B. W. (1929-1999) – Avon 1974, 1984; Cheshire 1969, 1974, 1978, 1982-1985, 1987, 1990, 1993, 1994, 1996, 1967; Cornwall 1986, 1992; Cumbria 1979, 1981-1983; Derbyshire 1969-1972, 1974, 1976-1982, 1984-1987, 1989-1994, 1996-1999; Devon 1988, 1996; Dorset 1997; Lancs. 1974, 1976, 1980; Northants. 1984; Northumbs. 1979; Shropshire 1980; Westmorland 1981; Wilts. 1971, 1984; Yorks. 1977, 1992; Cards. 1996; Denbigh 1970, 1982; Flint 1973; Skokholm 1995; Argyll 1980; Arran 1985; Ayrshire 1994; Caithness 1984; Coll 1983; Dumbarton 1978; Inverness 1981; Kintyre 1985; Perthshire 1978, 1985, 1986, 1998; Skye 1987; Sutherland 1984
Fryday, A. – Yorks. 1984, 1985; Skye 1987; Co. Antrim 1986

* Gardiner, W. (1808-1852) – Aberdeenshire 1844; Forfar 1840-1847; Perthshire 1842
Gibson [cf. S.Gibson (*c.*1789/90-1849)] – Yorks. *c.*1842 [ex herb. Spruce]
Gilbert, O. L. – Cheshire 1983,1984,1992
Gray, C. O. [all probably ex herb.] – Oxfordshire n.d.; Shropshire 1834; Worcs. 1834, 1835; Cards. 1835; Pembs. 1834
Gregory, C. – Caerns. 1970
Guest, J. P. – Cheshire 1987
* Hardy, J. (1817-1884) [some may be ex herb.; see also Carroll] – Cheshire 1849; Derbyshire 1846, 1847; Westmorland 1849; Yorks. 1841, 1844, 1846, 1847
Hawksworth, D. L. – Devon 1975
Hemmings, J. [details unknown] – Sussex 1854
Hepworth, [? J.], [details unknown] – Bucks. 1872 [ex herb. Mott]
Herbert, S. [details unknown] – Orkney 1901
* Hitch, C. J. B. – Devon 1978; Dorset 1978; Lancs. 1976, 1977; Northumbs. 1976; Suffolk 1978, 1979, 1981; Westmorland 1977; Yorks. 1976, 1977; Denbigh 1977; Banff 1977; Inverness 1977, Perthshire 1970, 1971; Ross 1977; Sutherland 1977
Holl, H. B. (1820-1886) – Devon; Worcs.; Merioneth [all undated & ex herb. Crombie]
Holmes, E. M. (1843-1930) – Surrey 1881; Sussex n.d.
Holt, G. A. (1852-1921) – Merioneth 1885
Hooker, W. J. (1785-1865) – Cairngorm [*c.*1834]
Hounsome, M. V. – Ayrshire 1994
Ibbotson, H. (1814-1886) – Yorks. [*c.*1844] [ex herb. Spruce]
* Johnson, W. (1844-1919) – Cumbs. 1878-1881; Durham 1879; Northumbs. 1878
Joshua, W. (1828-1898) – Glos.; Somerset; Surrey [all undated & ex herb. Crombie]
Knowles, M. C. (1864-1933) – Co. Wicklow 1929
Lang, W. H. (1874-1960) – Cheshire 1929
Larbalestier, C. du B. (1838-1911) – Channel Islands [undated & mostly exsiccatae]
Lawson, A. K. [details unknown] – Co. Antrim 1927
Leefe, J. E. (1824-1899) – Essex n.d.
Lees, F. A. (1847-1921) – Yorks. 1887
* Leighton, W. A. (1805-1889) – Shropshire, etc. [undated & mostly exsiccatae]
Lewis, J. H. [details unknown] – Cheshire 1884; Derbyshire 1883; Isle of Man 1890; Westmorland 1882, 1883; Caerns. 1884, 1885, 1888
Lowell, J. – Lancs. 1997; Aberdeenshire 1996
* McAndrew, J. (1836-1917) – Kirkudbright 1881-1885
MacKay, J. T. (1775-1862) – Co. Cork n.d. [ex herb. Windsor; see also Bohler]
Martindale, J. A. (1837-1914) – Westmorland n.d. [ex herb. Crombie]
Massee, G. E. (1850-1917) – Cumbs. n.d.
Melvill, J. C. D. (1845-1929) [or ex herb. Melvill] – Devon 1890
Milne, J. E. & D. – Derbyshire 1973; Isle of Man 1972, 1976
Moore, D. (1807-1879) – Co. Kerry n.d.
Mott, F. T. (1825-1908) – Leics.; Sussex 1872; Denbigh. 1873
* Mudd, W. (?1830-1879) – Durham 1853; Yorks. (Cleveland) 1853-1855
Müller, H. [details unknown] – Lancs. 1881 [ex herb. West]
Murray, H. M. [details unknown] – Isle of Man [*c.*1897]
Nuttall, W. [details unknown] – Cumbs. 1881; Caerns. 1879
Oakeshott, B. M. (fl. 1856-1897) – Sussex 1876
Pacey, N. R. – Derbyshire 1994
Pattison, E. (*c.*1840-1926) – Caerns. 1896
* Ralfs, J. (1807-1890) – Cornwall 1839-1841; Devon 1835, 1836; Caerns. 1840, 1844; Merioneth 1839,1841
Richards, M. – Outer Hebrides 1958 [ex herb. Tallis]
Roberts [? W.] (1862-1940) [details unknown] – Cornwall n.d. [? ex herb. de Crespigny]
Salwey, T. (1791-1877) – *loc. non. cit. c.*1830

Seaward, M. R. D. – Cumbs. 1993; Yorks. 1994, 1997, 1999, 2000
Simmonds, T. W. [details unknown] – Edinburgh 1803 [some via Don, det. Bohler; Windsor handwriting & ex herb. Windsor]
* Spruce, R. (1817-1893) – Yorks. 1840-1842, 1846, 1847; Co. Kerry 1842; also with Borrer [all in Spruce handwriting]: Kent 1846; Sussex 1846
Stokes, (Dr) [details unknown] – Lough Bray n.d.
* Tallis, J. H. – Hants. 1955, 1956; Wilts. 1956; Anglesey 1955; Cards. 1957, 1958; Caerns. 1955, 1956; Pembs. 1958; Inverness 1956; Co. Clare 1957; Co. Galway 1957
* Taylor, T. (?1786-1848) – Co. Kerry 1836, 1842 [some undated; all in Spruce's handwriting & ex herb. Spruce]
Tellam, R.V. (1826-1908) – Cornwall 1878, 1885
* Templeton, J. (1766-1826) – Belfast area (Co. Antrim/Co. Down) 1807, 1809, 1810, 1813, 1826 [but mainly undated; all in Spruce handwriting & ex herb. Spruce]
Topham, P. B. – Forfar 1967,1980; Perthshire 1971, 1978
Wade, A. E. (1895-1989) – Pembs. 1958
Weiss, F. E. (1865-1953) – Isle of Man 1896; Shropshire 1903
* West, W. (1848-1914) – Derbyshire 1881; Lancs. 1879, 1881; Westmorland 1881, 1882; Yorks. 1878-1883, 1887; Aberdeenshire 1880; Perthshire 1880
Wigglesworth, G. – Cheshire 1934, 1936, 1937; Merioneth 1938
* Willan, P. L. T. – Cornwall 1965-1967, 1972; Devon 1964, 1969; Dorset 1969; Glos. 1965; Hunts. 1965; Kent 1967; Leics. 1964, 1966, 1967, 1969; Norfolk 1965; Northants. 1969; Rutland 1969; Surrey 1967; Sussex 1967; Westmorland 1965; Worcs. 1967; Anglesey 1968; Argyll 1965; Ross & Cromarty 1965, 1966; Skye 1965; Wigtown 1965; Co. Cork 1967; Co. Kerry 1967
* Windsor, J. (1787-1868) – Yorks. 1812, 1813 [but mostly undated]
Wood, J. B. (1813-1890) – Forfar 1840, 1841 [or ex herb. – cf. W. Gardiner]
Woods, R. G. – Cheshire 1988
Wright, I. – Co. Cork n.d. [ex herb. Carroll]

Exsiccatae
Crombie, J. M., *Lichenes Britannici Exsiccati*
Larbalestier, C. du B., *Lichenes Caesariensis et Sargiensis Exsiccati*
Leighton, W. A., *Lichenes Britannici Exsiccati*
Mudd, W., *Lichenes Britannici Exsiccati*

Foreign Collectors
Adlerz, E. (1854-1918) – Sweden 1889
Aigret, C. (1856-1921) – Belgium 1884
* Arnold, F. C. G. (1828-1901) – Austria 1867, 1868, 1870, 1872, 1876, 1879-1886; Germany 1858, 1863, 1871, 1872, 1876, 1882, 1896
Baenitz, C. G. (1837-1913) – Germany 1873
Bailey, C. (1838-1924) – Iceland 1861; Norway 1863
Bang, M. (*c*.1853-?) – Bolivia 1890, 1893
Barfoot, W. [details unknown] – Norway 1878
Barker, T. (1838-1907) – Norway 1880
* Baron, G. – Seychelles 1983
Bastow, R. A. (1839-1920) – Tasmania 1884-1886
Beckhaus, C. (1821-1890) – Germany 1877
Blomberg, O. G. (1838-1901) – Sweden 1883, 1889, 1890
Boll, G. (?-1915) – Germany 1885
Boullu, A. E. (1813-1904) – France 1884
Bourgeau, E. (1813-1877) – Tenerife 1844, 1852, 1855
Bové, N. (1812-1841) – Algeria 1839
Bower, J. [details unknown] – USA n.d.

Brierley, M. [details unknown] – USA *c.*1882
Brodie, A. O. [details unknown] – Sri Lanka 1856, 1862; USA 1856
Burt [details unknown] – East Indies n.d.
Carroll, I. (1828-1880) – Iceland 1861; Norway 1863 [see Fox & Scannell 2000]
Chadwick, S. [details unknown] – New Zealand 1896
Chodat, R. H. (1865-1934) – Switzerland n.d.
Claussen, P. (?-1855) – Brazil 1842
Coleman (Miss) [? E: fl. 1922-1951; details unknown] – Falkland Islands, n.d.
Crombie, J. M. (1830-1906) – France n.d.
Dannenberg, E. G. (1826-1896) – Germany 1883
Daniëls, F. J. A. – Greenland 1968
Demetrio, C. H. (1845-1936) – USA 1891
Dietrich, D. N. F. (1799-1888) – Germany 1861
Dobson, S. – USA 1995
Dufour, J. M. L. (1779-1865) – Pyrenees, n.d.
Durando, G.-L. (1811-1892) – Algeria 1855
Edwards, S. R. – S. Africa 1988, 1999; France 1992
Eggerth, K. (1861-1888) – Austria n.d.
Ellis, R. [details unknown] – N. W. Himalayas 1880
Felippone, F. (1853-*c.*1930) – Uruguay 1895
* Fox, B. W. (1929-1999) – Austria 1970, 1971; Indonesia 1992; Seychelles (including Aldabra) 1994; Switzerland 1971
Gandoger, M. (1850-1926) – Tunisia 1907
Goetze, E. A. – S. Africa 1964
* Green, H. A. (1839-1912) – USA 1882, 1883
Greschik, V. (1862-1946) – Hungary 1889
* Helms, R. (1842-1914) – New Zealand 1888
Heywood, J. (?-1902) – New Zealand 1899, 1900
* Hodgkinson, A. [details unknown] – Canada 1897
Holl, F. [? F. C. 1794-1856] – Germany 1815
Hooker, J. D. (1817-1911) – Cockburn Island 1844; Kerguelen Islands n.d. [ex herb. R. Spruce]
Hurry, J. [details unknown] – St Helena 1889
Jaczewski, A. L. A. de (1863-1932) – Russia 1894
Jones, A. N. – Norway 1958
Jurgensen, C. [details unknown] – Mexico 1843, 1844
Jussuf, (General) [fl.1856; details unknown] – Algeria n.d.
Kantvilas, G. – Australia 1997
Kershaw, K. A. – Norway 1958
Krieger, K. W. (1848-1921) – Germany 1876
Lee, H. [details unknown] – Greenland 1871, ?1891
Lerou, A. [details unknown] – France 1859
Lewis, J. H. (?-*c.*1895) – USA 1883
Lindig, A. [details unknown] – Colombia n.d. [*c.*1860-1863]
Lodder, (Miss) – [details unknown] – Tasmania 1885
Lorentz, P. G. (1835-1881) – Uruguay 1877
Lösch, A. (1865-1946) – Germany 1893
* Macoun, J. (1831-1920) – Canada 1869, 1875, 1876, 1878-1885, 1887, 1889-1898
Melvill, E. H. N. [or S. H. M.] & A. H. [details unknown] – Austria 1893
Melvill, J. C. D. (1845-1929) – Austria (Tirol) 1897; ?Belgium n.d.; Switzerland 1882
Middleton, R. M. (1846-1909) – Chile 1905, 1906; USA 1892
Milne [cf. W. G. ?-1886; details unknown] – New Zealand n.d.
Molenaar, J. G. de – Greenland 1968
Morey, L. [details unknown] – USA 1883

Muhr, L.-E. – Sweden 1976-1980
Müller, H. L. H. (1829-1883) – *loc. non cit.* 1872
Murray, A. [details unknown] – Canada n.d.
Orphanides, T. G. (1817-1886) – Greece n.d. [1870s]
Pearcey, F. G. [details unknown] – Australia 1896
Pelvet, F. A. (1801-1882) – France n.d.
Percy, J. (1817-1889) – Switzerland 1836,1837
Philippe, X. (1802-1866) – ? Pyrenees n.d. [ex herb. Spruce]
Plant [details unknown] – Mexico n.d.
Pos, R. – France 1968
Raven, E. [details unknown] – New Zealand n.d.
Reboud, V. C. (1821-1889) – Algeria 1856, 1857
Reed, J. E. [details unknown] – USA 1881, 1884
Rehm, H. S. L. F. F. (1828-1916) – Germany n.d.
Richardson, J. (1787-1865) – Canada 1826
Robillard, V. de [or G.?; details unknown] – Mauritius 1887
Roumeguère, C. (1828-1892) – France 1886
Rugel, F. I. X. (1806-1878) – USA 1841
* Schaerer, L. E. (1785-1853) – Switzerland 1823 [mainly undated]
Schmidt, J. K. (1793-1850) – Germany 1815
Scholes, W. H. [details unknown] – Brazil 1881
Schönach, H. (1847-?) – Austria 1886
Seaward, M. R. D. – Brazil 1997; Chagos Archipelago 1996; Poland 1986; Seychelles 2000
Seringa, N. C. (1776-1858) – Switzerland n.d.
Sinclair, A. (*c.*1796-1861) – New Zealand 1860
Smith, G. – Nepal 1973
Smith, J. S. [details unknown] – Madeira 1880
* Spruce, R. (1817-1893) – Pyrenees n.d. [1845-1846]
Steiner, J. (1844-1918) – Austria n.d.
Steinmann [details unknown] – Chile n.d.
Stephenson, W. (fl.1810-*c.*1863) – New Zealand 1843, 1844
Tallis, J. H. – Norway 1958
Tehler, A. – Mexico 1993, 1995, 1996; South Africa 1996; USA 1994
* Thwaites, G. H. K. (1812-1882) – Sri Lanka [*c.*1860s] (det. W. A. Leighton; see Leighton 1869)
Vallentin, E. F. (1873-1924) – Falkland Islands 1911
Walton, J. (1895-1971) – Norway 1921
Watson, G. (1795-1858) – USA n.d. [*c.*1841]
Weedon [details unknown] – USA 1875
Wegelin, H. (1853-?) – Switzerland 1882
Weidmann, A. (1830-1915) – Czech Republic 1886,1887
Weiss, F. E. (1865-1953) – South Africa 1905
Wells, A. [details unknown] – France/Switzerland 1836
Wickbom, J. A. O. (1851-?) – Norway 1870
Wigglesworth, G. (1877-1972) – Norway 1936
Wilds [details unknown] – Jamaica n.d.
Wolseley, P. – Australia 1997
Zetterstedt, J. E. (1828-1880) – Norway 1870

Exsiccatae [incomplete, sometimes only as odd packets]
Arnold, F. C. G., *Lichenes Exsiccati*
Arnold, F. C. G., *Lichenes Monacenses Exsiccati*
Bourgeau, E., *Plantae Canariensis*

Flora Exsiccata Austro Hungarica
Flora Exsiccata de C. Billot
Flora Romaniae Exsiccata
Lojka, H., *Lichenotheca Universalis*
Macoun, J., *Canadian Lichens*
Magnier, C., *Flora Selecta Exsiccata*
Magnier, C., *Plantae Galliae Septentrionalis et Belgii*
Migula, W., *Cryptogamae Germaniae, Austriae et Helvetiae Exsiccatae*
Schaerer, L. E., *Lichenes Helvetici Exsiccati*
Schultz, F. W., *Herbarium Normale*
Schultz, F. W. & Winter, F., *Herbarium Normale*
Wagner, H., *Cryptogamen Herbarium*

Acknowledgements

The author is deeply appreciative of the conferment of the title of Honorary Research Associate by The Manchester Museum and is especially indebted to Dr Sean R. Edwards and his colleagues for their encouragement and active support. He also acknowledges the very considerable help afforded by Dr Brian J. Coppins, particularly in the identification of the more critical material.

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BOOK REVIEW

Rainforest by **Sara Oldfield** with photography by **Bruce Coleman Collection** and a Foreword by **Mark Rose**. Pp. 160. New Holland Publishers, London. 2002. £24.99, hardback.

Rainforest is a book of wonderful photographs accompanied by a clear message: humans are destroying a (*sic*) vanishing habitat. Although there is heartening news here and there, there are unwelcome reminders of destruction, such as slash and burn, short term financial gain, logging, too late for the trees, endangered species, and frenzy for gold, on most pages.

P. W. Richards wrote, over half a century ago, that until very recently virgin rainforest covered a large fraction of the earth's surface, and he mapped areas where rainforest appears to be the natural climax under 'present [mid-20th century] conditions'. These areas correspond largely with those on a map, entitled Original Rainforest Areas of the World, and estimated as a six percent surface cover, in the book reviewed here. Among all the reports of damage to, and fragmentation of, the forests, the likely adverse effects of 21st century climate change (fuelled, in small part, by ecotourism as well as by more frivolous jet travel) are not mentioned. The importance of rainforests as regulators of the world's climate, and as storehouses for diversity is emphasised. The poor cannot be blamed for forest destruction carried out for their own survival, but politicians who tolerate the conditions leading to such destruction, or who abet excessive commercial exploitation, should be held to account; there are plenty of 'statistics' in the book that might be quoted to them.

This book, like modern television programmes on natural history, provides those in the developed world with close up visual access to rainforest plants and animals without the sweat, toil, luck and the burning of fossil fuel involved in viewing them *in situ*. The 'hands on' experience of local Nature enjoyed by many children in Britain, for example, until around the middle of the last century, is now available to only a few, and is circumscribed not only by parental fears for safety, but by regulations concerned with conservation; we live in a world of visualisation rather than experience. Populist books and television provide the closest contact that the majority get with any aspect of Nature; they function as opinion formers. Books such as *Rainforest* provide some impetus towards preserving what is left of the world's biodiversity. Ultimately, however, it is only the peoples who live in climatic rainforest areas who can conserve this diversity; most have no access to expensive books, and little comprehension of the global significance of forests; people elsewhere can help by avoiding contributing to 'demands' for unsustainable rainforest 'products' including exotic timbers, exotic pets, bushmeat, and absurd 'medications' derived from animal parts; a 'demand' will always be met by commerce, legal or illegal.

Rainforest covers, in ten chapters, the rainforests of the world, region by region, each with from 6 to 16 pages of information on the flora, fauna, economics and conservation problems. The information is accurate, but, obviously, cannot be detailed, and some of the brilliant photographs are accompanied by tantalisingly little specific information: 'Caterpillars on a leaf in Costa Rica' is one caption. There is a comprehensive index, a less comprehensive list of rainforest species of concern, a list of addresses of key conservation bodies, and information on relevant newsletters and websites.

This book, written by the Global Programmes Director of Flora and Fauna International, is recommended for the reasons given above, and because royalty proceeds will go to the Global Trees Campaign.

DJH

THE WASPS AND BEES (*HYMENOPTERA: ACULEATA*) OF REMNANT SITES IN INTENSIVE AGRICULTURAL COUNTRYSIDE IN WATSONIAN YORKSHIRE: BRAYTON BARFF, RINGHAY WOOD, SOUTH CLIFFE COMMON AND THORNTON ELLERS

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Lowland landscapes in Britain are highly fragmented and semi-natural habitat, which often survive as isolated patches embedded in intensive farmland (Fuller 1999). Such isolated fragments can have interesting assemblages of aculeate wasps and bees. This paper considers four such sites.

Brayton Barff (SE5830) (Selby district of North Yorkshire county), in the Humberhead Levels natural area, is situated next to the village of Thorpe Willoughby, *c*.4 km west of Selby. The site, of *c*.30.6 ha, is an isolated hill covered by open deciduous woodland. The open areas include a sand pit and flower-rich grassland. Bramble is extensive between the mainly oak woodland and the open grassy areas.

Ringhay Wood (SE4535) with the grounds of Lotherton Hall (Leeds Unitary Authority) (*c*.20 ha) is situated in the Southern Magnesium Limestone natural area. It is *c*.1.5 km south-east of Aberford and *c*.8.5 km south-west of Tadcaster. The grounds of Lotherton Hall consist of open woodland, shrubs, herb-rich meadow and gardens with old brick walls. Dead wood in sunny situations, which was used by aerial nesting aculeates, has now mostly been removed. Ringhay Wood is open calcareous woodland. The open areas are herb-rich with dead wood which is becoming covered by plant growth and bare flat and sloping ground used by subterranean nesting aculeates.

South Cliffe Common (SE8635) (East Riding of Yorkshire Unitary Authority) is situated in the Humberhead Levels natural area, *c*.6 km north-west of North Cave and *c*.6 km south-west of Market Weighton. The site, of *c*.41 ha, is mainly sandy lowland heathland, acid dry grassland, deciduous woodland and bare sandy flat areas with slopes and vertical banks. The site is a very small remnant of a once much more extensive series of sandy habitats.

Thornton Ellers (SE7245) (East Riding of Yorkshire Unitary Authority) is situated in the Vale of York and Mowbray natural area, *c*.5 km south of Wilberfoss and c.8 km south-west of Pocklington. The very small sandy site, of *c*.4 ha, consists of open woodland, shrubs (particularly gorse), dry acid grassland and bare sandy areas including a pit with a pond. Bare flat areas and sloping and vertical banks are plentiful, providing nesting sites for subterranean aculeates.

Methods

Between 1996 and 2001, 19 visits were made to Brayton Barff, distributed throughout the year as follows: April (2 visits), May (4), June (4), July (4), August (4), September (1). In addition W. J. Fordham visited the site on 12 Aug. 1917 finding two species identified by C. Morley, P. Kendall visited three times (6 Aug. 1981, 31 Aug. 1983, 5 May 1992) finding four species identified by the author, and A. Godfrey visited on 19 July 2000 finding one species identified by himself.

Between 1992 and 2000, 17 visits were made to Ringhay Wood and Lotherton Hall, distributed throughout the year as follows: April (2), May (3), June (4), July (4), August (3), September (1).

Between 1988 and 1996, 15 visits were made to South Cliffe Common, distributed throughout the year as follows: April (1), May (3), June (3), July (4), August (3), September (1).

Between 1991 and 1998, 14 visits were made to Thornton Ellers, distributed throughout the year as follows: April (1), May (3), June (3), July (3), August (3), September (1). In

addition M. L. Denton visited the site on 24 June 1989 finding one species identified by the author.

During my visits, which lasted for approximately two to three hours, all species of aculeate wasps and bees were recorded (Archer sample) and usually collected with a hand net for identification.

In the following account, the nomenclature can be related to that of Kloet and Hincks (1978). An up-to-date checklist can be found on the Bees, Wasps and Ants Recording Society (BWARS) web pages at http://www.bwars.com.

Species Present and Seasonal progression of Species

A full list of recorded species is given in the Appendix. At the family level, Tables 1 and 2 show the taxonomic distribution of species and records. A record represents a specimen differing in one of the following three variables: name, sex and day of visit. The solitary wasp family, Sphecidae, and the solitary bee subfamilies, Andreninae and Halictinae, are the dominant taxa in terms of the number of species and records, although the bee subfamily, Anthophorinae, is also important. South Cliffe Common and Thornton Ellers provided, on average, more solitary species per visit than Brayton Barff and Ringhay Wood with Lotherton Hall.

Table 3 shows the number of species and when species were first recorded for each month. The most productive month for the solitary wasp species for all four sites was July. Most species of solitary wasps were first recorded during June or July. Since June and July are summer months, most solitary wasp species would seem to have to wait until the warmer summer months before the adults can become active. The most numerous solitary wasp species recorded were: from Brayton Barff – *Crabro peltarius*, a subterranean nester found in a large aggregation in the sand pit, and the subterranean nesters *Crossocerus ovalis* and *Oxybelus uniglumis*; from Ringhay Wood with Lotherton Hall – the subterranean nester *Crossocerus elongatulus*, the parasite, *Chrysis ignita*, and the aerial nesters *Ectemnius cavifrons* and *E. cephalotes* whose workings in dead wood are made evident by the presence of wood shavings; from South Cliffe Common – the subterranean nesters *Oxybelus uniglumis*, *Mellinus arvensis*, *Arachnospila spissa* and *Crossocerus quadrimaculatus*; and from Thornton Ellers – the subterranean nesters *Oxybelus uniglumis* and *Crossocerus quadrimaculatus*, the cleptoparasite *Evagetes crassicornis* and the aerial nester *Ancistrocerus trifasciatus*. The wingless female parasite, *Myrmosa atra*, was found with its host *Oxybelus uniglumis* at Brayton Barff, South Cliffe Common and Thornton Ellers. The host of *Chrysis ignita* could have been *Ancistrocerus trifasciatus*, although the association between these two species has not been firmly established. *Chrysis impressa* has been found to be the parasite of *Ancistrocerus trifasciatus* and both these species were found at Thornton Ellers. The host of *Evagetes crassicornis* at Thornton Ellers was probably the recorded *Arachnospila anceps*. The female of *E. crassicornis* enters the cell of its host, eats the host's egg and substitutes its own.

The most productive month for solitary bee species was May, although sometimes June was nearly as important. May was also the most productive month for the first recording of species. Thus, in contrast to the solitary wasps the solitary bees species are mainly restricted to the late spring, although some species are found during the spring and summer, e.g. species of *Halictus*, *Lasioglossum* and *Sphecodes*, and some species are restricted to the summer, e.g. *Colletes succinctus* with its cleptoparasite *Epeolus cruciger, Andrena fuscipes* with its cleptoparasite *Nomada rufipes* and *Anthophora furcata*. The most numerous solitary bee species recorded from Brayton Barff were *Lasioglossum leucozonium, Andrena cineraria, A. wilkella* and *A. haemorrhoa*; from Ringhay Wood with Lotherton Hall *Halictus tumulorum*, *Andrena chrysosceles* and *Lasioglossum smeathamellum*; from South Cliffe Common *Andrena barbilabris* with its cleptoparasite *Sphecodes pellucidus, Colletes succinctus* and *Lasioglossum rufitarse*; and from Thornton Ellers *Lasioglossum villosulum* with its cleptoparasite *Sphecodes geoffrellus* and the cleptoparasite *S. monilicornis* whose hosts were probably the recorded *Halictus rubicundus*

TABLE 1
The number of species of aculeate wasps and bees recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	Brayton	Ringhay	South Cliffe	Thornton
Solitary wasps				
Chrysididae	2	4	4	6
Mutillidae	1	0	1	1
Pompilidae	3	3	8	8
Eumeninae	4	1	1	3
Sphecidae	23	16	25	23
Total solitary wasps	33	24	39	41
Solitary bees				
Colletinae	2	1	2	2
Andreninae	13	10	9	8
Halictinae	13	10	8	11
Megachilinae	4	3	1	3
Anthophorinae	7	8	6	6
Total solitary bee	39	32	26	30
Total solitary species	72	56	65	71
Social wasps and bees				
Vespinae	4	6	5	4
Apinae	11	10	9	8
Total social species	15	16	14	12
Total wasps and bees	87	72	79	83

TABLE 2
The number of records of solitary wasps and bees in the Archer sample from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	Brayton	Ringhay	South Cliffe	Thornton
Solitary wasps				
Chrysididae	3	11	12	12
Mutillidae	2	0	1	2
Pompilidae	3	3	20	25
Eumeninae	6	3	3	9
Sphecidae	77	41	83	62
Total solitary waps	91	58	119	110
Solitary bees				
Colletinae	3	3	8	5
Andreninae	47	49	27	23
Halictinae	41	38	28	44
Megachilinae	7	6	1	4
Anthophorinae	14	16	13	21
Total solitary bee	112	112	77	97
Total solitary species	203	170	196	207
No. records per visit	10.7	10.0	13.1	14.8

TABLE 3
The number of species, and when species were first recorded, per month of solitary species at Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers (Archer sample).

	Apr	May	Jun	Jul	Aug	Sep
No. species – Wasps						
Brayton	0	1	14	21	13	3
Ringhay	0	5	11	16	9	0
South Cliffe	0	9	16	31	13	2
Thornton	0	3	19	26	14	5
No. species – Bees						
Brayton	9	18	17	12	10	4
Ringhay	7	21	17	13	6	2
South Cliffe	3	17	7	10	7	3
Thornton	3	23	12	11	5	2
No. species first recorded – Wasps						
Brayton	0	1	13	12	5	1
Ringhay	0	5	7	10	2	0
South Cliffe	0	9	9	17	4	0
Thornton	0	3	18	15	5	0
No. species first recorded – Bees						
Brayton	9	13	10	4	3	0
Ringhay	7	14	6	3	2	0
South Cliffe	3	14	1	8	0	0
Thornton	3	21	1	5	0	0

and *Lasioglossum calceatum*. All these bee species are subterranean nesters or cleptoparasites of subterranean nesters. The cleptoparasites of *Andrena haemorrhoa* and *Halictus tumulorum* were not recorded, perhaps indicating that these cleptoparasites have become extinct, because their populations have become too small to support them on the isolated sites.

Estimating the potential number of Solitary Wasp and Bee Species

To determine whether to stop recording from a site it is necessary to estimate the potential number of species that might be found there. Normally to use such statistical procedures it has been necessary not only to know the species found on a visit but also the number of individuals of each species. The data collected by the author was only on the species present on a visit. Recently non-parametric statistical procedures have become available to estimate the potential number of species on a site when only presence data are available. The statistical procedures used are the presence/absence Chao (in Colwell & Coddington 1944) and jackknife (Heltshe & Forrester 1983) estimators, using the software of Pisces Conservation Ltd. The Chao estimate depends on the number of species found and the number of species found on one (unique species) and two (duo species) visits or samples. The jackknife estimate also depends on the number of species found and the number of unique species. The statistical procedures are run a number of times equal to the number of samples or visits. In practice the software selects 1, 2, etc. samples at random each time calculating a mean estimate of species richness. With a small number of samples the estimates are erratic, but as larger sample sizes are selected the estimates may stabilize giving confidence in them. The Chao and jackknife estimates with increasing sample size from the largest number of samples are shown in Table 4.

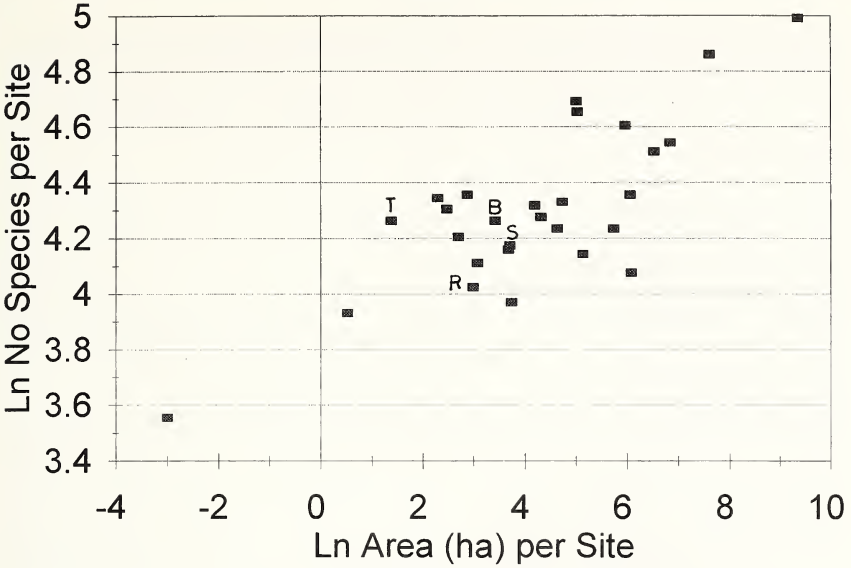

FIGURE 1.
Species-area plot for sites from the north and north Midlands of England.
(B = Brayton Barff, R = Ringhay Wood with Lotherton Hall, S = South Cliffe Common, T = Thornton Ellers).

For all four sites the Chao and jackknife estimates stabilize so giving confidence in them. The Chao and jackknife estimates for each site are very similar to each other, except possibly Thornton Ellers. It can be calculated that over 70% of the potential number of species have been recorded, which, as a rough measure, can be considered as the stopping point for recording from a site.

It is assumed that the estimates are of the number of species resident on a site, but could include vagrant and tourist species. Vagrant species are species found well outside their normal geographical distribution and tourist species are species that do not nest on, or regularly use, the study site for food or other resources. Vagrant and tourist species, if recorded as unique species could lead to an inability to stabilize the estimates. Archer (2000a, 2000b) found that at Hartlebury Common in Worcestershire the estimates only stabilized after the tourist species had been excluded from the estimating procedures. However, even if the estimates stabilize, the estimates may represent resident and tourist species since with increasing sample size even the tourist species may cease to be unique. No vagrant species were found at the four sites but it is more difficult to determine if any tourist species were present.

What is the Natural History or Conservation Value of Each Site

At a national level (Shirt 1987, Falk 1991) Brayton Barff has a scarce species (Na) *Nomada integra* (= *N. pleurosticta*), South Cliffe Common has a scarce species (Nb) *Priocnemis schioedtei* and Thornton Ellers has two Red Data Book species (*Andrena ruficrus* and *Nomada lathburiana*) and a scarce species (Nb) *Nysson trimaculatus*. Recent investigations by BWARS (Archer 2002c) indicate that *P. schioedtei*, *N. lathburiana* and *N. trimaculatus* should be downgraded and lose their national status. Again, recent

TABLE 4
Non-parametric estimates of species richness of solitary species at Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers (Archer sample)

	Chao estimate	Jackknife estimate.
Brayton Barff		
No. species – recorded	71	71
– estimated	99	99
95% confidence limits	76-122	86-112
% of estimated spp. found	72	72
Ringhay Wood with Lotherton Hall		
No. species – recorded	56	56
– estimated	76	76
95% confidence limits	56-96	66-86
% of estimated spp. found	74	74
South Cliffe Common		
No. species – recorded	65	65
– estimated	86	87
95% confidence limits	66-105	77-98
% of estimated spp. found	76	75
Thornton Ellers		
No. species – recorded	71	71
– estimated	86	95
95% confidence limits	72-101	79-112
% of estimated spp. found	83	75

investigations by BWARS (Archer 2002c) indicate the following species should be upgraded in importance at the national level: from Brayton Barff *Chrysis viridula*, from South Cliffe Common *Diodontus tristis* and *Ectemnius dives* and from Thornton Ellers *Diodontus tristis*. In summary all the sites, except Ringhay Wood with Lotherton Hall, have recorded species of national importance, and especially noteworthy the presence of *Andrena ruficrus* at Thornton Ellers.

With the help of latest information from BWARS, all species may be given a national status score (Archer 2002c) depending on their rarity and distribution. The definitions of the six statuses used are given in Archer (1999, 2002c). Adding the status scores for each species from a site gives a national Quality Score, while dividing the Quality Score by the number of species found on a site gives the national Species Quality Score (SQS) (Table 5). Although quality scores are greatly influenced by the areas of sites, the SQSs are relatively independent of site area (Archer 1999) and can be used to compare different Yorkshire sites.

SQSs have been determined for 23 Yorkshire sites and range from 1.2 to 2.9. These sites can be divided into three groups depending on their SQSs as follows: first class 2.4-2.9 (e.g. Crow Wood), second class 1.8-2.3 (e.g. Strensall Common, Duncombe Park) and third class 1.2-1.7 (e.g. Cave Wold, Seckar Moor). Using SQSs from Table 5 all the current study sites are third class except for Thornton Ellers which is a second class site. Therefore, it is likely that the isolation of these sites has resulted in their lower SQSs. Other Yorkshire third class sites, e.g. Burton Leonard Lime Quarries, Holmehouse Wood near Keighley, Seckar Moor and Rossington Bridge, could also be considered as isolated sites.

In a Yorkshire context, using the number of species recorded from a site can be used as a crude measure of the quality of a site (Archer 2002c). Brayton Barff is a very good site and Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers are good sites. Furthermore, the following species are considered rare in Yorkshire (Archer 2002c):

TABLE 5

The Archer national quality scores of the solitary species recorded at Brayton Barff (B), Ringhay Wood with Lotherton Hall (R), South Cliffe Common (S) and Thornton Ellers (T).

National status	Status values (A)	No. species (B)				Quality scores (A x B)			
		B	R	S	T	B	R	S	T
Universal	1	46	37	46	48	46	37	46	48
Widespread	2	24	19	17	21	48	38	34	42
Restricted	4	0	0	0	0	0	0	0	0
Scarce	8	1	0	2	1	8	0	16	8
Rare	16	1	0	0	0	16	0	0	0
Very rare	32	0	0	0	1	0	0	0	32
Total (Quality Score)		72	56	65	71	118	75	96	130
Species Quality Score (Quality Score/B)						1.6	1.3	1.5	1.8

from Brayton Barff *Vespa crabro* and *Bombus rupestris* and from South Cliffe Common *Mimesa lutaria*. The discovery of *B. rupestris* is particularly significant as previously it was considered extinct in Yorkshire.

Comparisons with Other Sites

Since the species diversity investigations have shown stable estimates for the four sites sufficient species have been recorded from each site to carry out comparisons with other sites. These will be made with respect to the areas of the sites, cleptoparasitic loads and aerial nester frequencies.

Species-area Relationships

The number of solitary species can be related to site area. The areas of Brayton Barff and Thornton Ellers are clearly defined on maps while the study area of South Cliffe Common can be readily determined. The study area of Ringhay Wood with Lotherton Hall is more difficult to determine since it was mainly based on a series of pathways and parts of the grounds of Lotherton Hall.

The species-area relationship can be found by plotting the number of solitary species recorded at a site against the area of the site, with both the number and area expressed as natural logarithms (ln). Figure 1 shows a species-area plot for 28 sites from the north and north Midlands of England including the current study sites. The correlation coefficient of 0.786 is highly statistically significant ($p<0.001$) indicating a positive linear relationship between numbers of species and areas of sites. The coefficient of determination indicates that 61.8% of the variation of the number of species between sites can be explained by the variation in areas of sites. The regression equation for the relationship is: ln number of species = 3.90 + 0.097 x ln area (ha), which is similar to that given in Archer (2001) based on 18 sites.

Since the dots for the four current sites fall within the dots of the other sites (Fig. 1) the isolation of these sites has not prevented them from retaining the number of species that might be expected for their areas.

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasitic (or parasitoids) on other host aculeates. Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasitic rates are higher in temperate regions, as host populations are more synchronised in their life-history characteristics than in tropical regions. This finding probably does not hold for desert regions where the occurrence of rainfall would tend to synchronise life history

characteristics. From a review of the literature Wcislo found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%.

For 24 sites from north and north Midlands, the author found that CLs for solitary bees vary from 22.5% to 36.6% except for Duncombe Park, with a value of 14.1%. The low CL for Duncombe Park of 17.2% is due to the loss of *Sphecodes* cleptoparasites from this site. From Table 7, the CLs for Brayton Barff, Ringhay Wood with Lotherton Hall and South Cliffe Common fall within this range, while the CL for Thornton Ellers extends the upper limit to 40.0% giving a new range of 17.5%, which is very similar to the range found by Wcislo.

Wcislo gave no CLs for solitary wasps but from 24 sites from north and north Midlands of England CLs vary from 10.3% to 20.5%, a range of only 10.2%. From Table 6, the CLs for Brayton Barff, Ringhay Wood with Lotherton Hall and South Cliffe Common fall within this range, while the CL for Thornton Ellers extends the upper limit to 24.4% giving a range of 14.1%.

TABLE 6
The relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic load CL = 100 x C/(H+C)
Solitary wasps			
Brayton	28	5	15.2
Ringhay	20	4	16.7
South Cliffe	33	6	15.4
Thornton	31	10	24.4
Solitary bees			
Brayton	26	13	33.3
Ringhay	24	8	25.0
South Cliffe	17	9	34.6
Thornton	18	12	40.0

Aerial Nester Frequency

The aerial-nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters mainly use old beetle burrows in dead wood and central stem cavities such as dead bramble. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered. The AFs for the study sites are given in Table 7. The AFs for solitary wasps from 17 sites in Watsonian Yorkshire vary from 0.05 to 84.4% and for the British species is 46.2%. The AFs for Brayton Barff and Thornton Ellers are very near the British AF indicating the sites have a range of both aerial and subterranean nesting sites. The very high AF for Ringhay Wood with Lotherton Hall is due to the crevices in old walls within the gardens of Lotherton Hall and dead wood in sunny situations both in the gardens and in the open areas of the wood, besides the apparent lack of suitable subterranean nesting sites. Compared with the British AF the slightly lower AF for South Cliffe Common is mainly a consequence of the readily available subterranean nesting sites in the sandy banks of the drainage ditches and streams and in the numerous open sandy areas.

The AFs for the solitary bees from 17 sites in Watsonian Yorkshire vary from 7.1% to 30.0% and for the British species is 17.9%. The AFs for Brayton Barff, Ringhay Wood with Lotherton Hall and Thornton Ellers are near the British AF, while the AF for South Cliffe Common is lower. Unlike the solitary wasps, the solitary bees of Ringhay Wood are able to use the dry calcareous clayey bare slopes and flat ground for nesting. The reason for the

lower AF for South Cliffe Common is because of the readily available nest sites, as for the solitary wasps.

TABLE 7
The nesting habits of the solitary species recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = 100 x A/(A+S)
Solitary wasps			
Brayton	12	16	42.9
Ringhay	18	2	90.0
South Cliffe	10	23	30.3
Thornton	12	19	38.7
Solitary bees			
Brayton	5	21	19.2
Ringhay	5	19	20.8
South Cliffe	2	15	11.8
Thornton	4	14	22.2

Conclusions

1. In terms of the number of species, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers are good sites, and Brayton Barff is a very good site.
2. Estimates of the potential number of solitary species present on the four sites are stable and, therefore, it can be calculated that over 70% of the species on each site have been recorded.
3. All the sites, except for Ringhay Wood with Lotherton Hall, have species of national conservation concern. The presence of the RDB species, *Andrena ruficrus*, at Thornton Ellers and the discovery of *Bombus rupestris* at Brayton Barff are particularly significant.
4. Despite the isolation of the four sites, each site has about the number of solitary species expected in terms of the area of each site, although the number of high quality species probably is reduced.
5. Cleptoparasitic loads support the hypothesis of Wcislo.
6. Aerial nesters are particularly significant at Ringhay Wood with Lotherton Hall.

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Appendix

The list of aculeate wasps and bees recorded from Brayton Barff (BB), Ringhay Wood with Lotherton Hall (RW), South Cliffe Common (SC) and Thornton Ellers (TE).

Chrysididae: *Omalus auratus* (Linn.) (SC, TE), *Hedychridium ardens* (Latreille *in* Coquebert) (SC, TE), *Chrysis angustula* Schenck (RW, TE), *C. ignita* (Linn.) (RW, TE), *C. impressa* Schenck (BB, RW, SC, TE), *C. viridula* Linn. (BB), *Trichrysis cyanea* (Linn.) (RW, SC, TE).

Mutillidae: *Myrmosa atra* Panzer (BB, SC, TE).

Pompilidae: *Anoplius nigerrimus* Dufour (RW), *Arachnospila anceps* (Wesmael) (BB, SC, TE), *A. spissa* (Schiødte) (SC, TE), *Dipogon subintermedius* (Magretti) (= *nitidus*) (BB, RW, SC, TE), *Episyron rufipes* (Linn.) (SC, TE), *Evagetes crassicornis* (Shuchard) (BB, SC, TE), *Pompilus cinereus* (Fab.) (SC), *Priocnemis exaltata* (Fab.) (SC, TE), *P. fennica* Haupt (RW), *P. parvula* Dahlbom (TE), *P. perturbator* (Harris) (TE), *P. schioedtei* Haupt (SC).

Eumeninae: *Odynerus spinipes* (Linn.) (BB), *Ancistrocerus gazella* (Panzer) (BB), *A. oviventris* (Wesmael) (BB), *A. parietinus* (Linn.) (BB), *A. trifasciatus* (Müller) (RW, TE), *Symmorphus bifasciatus* (Linn.) (= *mutinensis*) (TE), *S. gracilis* (Brullé) (SC, TE).

Vespinae: *Vespa crabro* Linn. (BB), *Dolichovespula media* (Retzius) (RW), *D. norwegica* (Fab) (RW, SC), *D. sylvestris* (Scopoli) (BB, RW, SC, TE), *Paravespula germanica* (Fab.) (BB, RW, SC, TE), *P. vulgaris* (Linn.) (BB, RW, SC, TE), *Vespula rufa* (Linn.) (RW, SC, TE).

Sphecidae: *Astata pinguis* (Dahlbom) (BB, SC), *Tachysphex pompiliformis* (Panzer) (BB, SC, TE), *Trypoxylon attenuatum* Smith (SC), *T. clavicerum* Lepeletier & Serville (BB, RW), *T. figulus* (Linn.) (RW, SC, TE), *Crabro cribrarius* (Linn.) (BB, SC, TE), *C. peltarius* (Schreber) (BB, SC), *Crossocerus annulipes* (Lepeletier & Brullé) (RW), *C. capitosus* (Shuckard) (TE), *C. cetratus* (Shuckard) (RW), *C. dimidiatus* (Fab.) (RW), *C. elongatulus* (Vander Linden) (RW), *C. megacephalus* (Rossi) (RW, SC), *C. ovalis* (Lepeletier & Brullé) (BB, SC, TE), *C. podagricus* (Vander Linden) (BB, RW), *C. pusillus* (Lepeletier & Brullé) (BB, SC), *C. quadrimaculatus* (Fab.) (BB, SC, TE), *C. tarsatus* (Shuckard) (SC, TE), *C. wesmaeli* (Vander Linden) (SC), *Ectemnius cavifrons* (Thomson) (RW, SC, TE), *E. cephalotes* (Olivier) (BB, RW), *E. dives* (Lepeletier & Brullé) (SC), *Lindenius albilabris* (Fab.) (TE), *Rhopalum clavipes* (Linn.) (RW), *R. coarctatum* (Scopoli) (TE), *Oxybelus uniglumis* (Linn.) (BB, SC, TE), *Mimumesa dahlbomi* (Wesmael) (BB, SC, TE), *Mimesa equestris* (Fab.) (BB, SC), *M. lutaria* (Fab.) (SC), *Psenulus concolor* (Dahlbom) (TE), *P. pallipes* (Panzer) (BB, RW), *Pemphredon inornata* Say (RW, SC, TE), *P. lethifera* (Shuckard) (TE), *P. lugubris* (Fab.) (BB, RW, SC), *Diodontus luperus* Shuckard (BB), *D. minutus* (Fab.) (SC, TE), *D. tristis* (Vander Linden) (SC, TE), *Passaloecus corniger* Shuckard (BB, RW), *P. gracilis* Shuckard (RW), *P. singularis* Dahlbom (BB), *Ammophila sabulosa* (Linn.), (BB, SC, TE), *Mellinus arvensis* (Linn.) (BB, SC, TE), *Nysson spinosus* (Forster) (BB, TE), *N.*

trimaculatus (Rossi) (TE), *Gorytes quadrifasciatus* (Fab.) (BB, TE), *G. tumidus* (Panzer) (SC), *Argogorytes mystaceus* (Linn.) (BB, TE),

Colletinae: *Colletes daviesanus* Smith (BB, TE), *C. succinctus* (Linn.) (SC), *Hylaeus communis* Nylander (BB, RW, SC, TE).

Andreninae: *Andrena angustior* (Kirby) (BB), *A. barbilabris* (Kirby) (BB, SC), *A. bicolor* Fab. (RW), *A. chrysosceles* (Kirby) (BB, RW, SC, TE), *A. cineraria* (Linn.) (BB, SC, TE), *A. clarkella* (Kirby) (SC, TE), *A. denticulata* (Kirby) (BB), *A. fucata* Smith (RW), *A. fulva* (Müller *in* Allioni) (BB, RW, TE), *A. fuscipes* (Kirby) (SC), *A. haemorrhoa* (Fab.) (BB, RW, SC, TE), *A. helvola* (Linn.) (RW), *A. lapponica* Zetterstedt (SC), *A. minutula* (Kirby) (BB, RW), *A. nigroaenea* (Kirby) (BB, RW, SC, TE), *A. ruficrus* Nylander (TE), *Andrena semilaevis* Pérez (= *saundersella*) (BB), *A. scotica* Perkins (BB, RW, SC, TE), *A. subopaca* Nylander (BB, RW), *A. wilkella* (Kirby) (BB).

Halictinae: *Halictus rubicundus* (Christ) (BB, RW, SC, TE), *H. tumulorum* (Linn.) (BB, RW), *Lasioglossum albipes* (Fab.) (BB, RW), *L. calceatum* (Scopoli) (BB, TE), *L. cupromicans* (Pérez) (RW), *L. fratellum* (Pérez) (RW, SC), *L. fulvicorne* (Kirby) (RW), *L. leucopum* (Kirby) (BB, RW, TE), *L. leucozonium* (Schrank) (BB), *L. rufitarse* (Zetterstedt) (RW, SC, TE), *L. smeathmanellum* (Kirby) (RW), *L. villosulum* (Kirby) (BB, SC, TE), *Sphecodes ephippius* (Linn.) (BB), *S. geoffrellus* (Kirby) (= *fasciatus*) (BB, SC, TE), *S. gibbus* (Linn.) (BB, SC, TE), *S. hyalinatus* von Hagens (RW, TE), *S. monilicornis* (Kirby) (BB, SC, TE), *S. pellucidus* Smith (BB, SC, TE), *S. puncticeps* Thomson (BB, TE).

Megachilinae: *Chelostoma florisomne* (Linn.) (BB, RW), *Megachile versicolor* Smith (TE), *Megachile willughbiella* (Kirby) (BB, SC), *Osmia caerulescens* (Linn.), (BB, TE), *O. leaiana* (Kirby) (RW), *O. rufa* (Linn.) (BB, RW, TE).

Anthophorinae: *Nomada fabriciana* (Linn.) (BB, RW), *N. flavoguttata* (Kirby) (RW), *N. goodeniana* (Kirby) (BB, RW, SC, TE), *N. integra* Brullé (= *pleurosticta*) (BB), *N. lathburiana* (Kirby) (BB, TE), *N. leucophthalma* (Kirby) (RW, SC, TE), *N. marshamella* (Kirby) (BB, RW, SC, TE), *N. panzeri* Lepeletier (BB, RW, TE), *N. ruficornis* (Linn.) (RW, TE), *N. rufipes* Fab. (SC), *N. striata* Fab. (BB) *Epeolus cruciger* (Panzer) (SC), *Anthophora furcata* (Panzer) (RW), *A. plumipes* (Pallas) (SC).

Apinae: *Bombus hortorum* (Linn.) (RW, SC, TE), *B. lapidarius* (Linn.) (BB, RW, SC, TE), *B. lucorum* (Linn.) (BB, RW, SC, TE), *B. pascuorum* (Scopoli) (BB, RW, SC, TE), *B. pratorum* (Linn.) (BB, RW, SC, TE), *B. terrestris* (Linn.) (BB, RW, SC, TE), *B. bohemicus* (Seidl) (BB, RW, SC, TE), *B. campestris* (Panzer) (BB), *B. rupestris* (Fab.) (BB), *B. sylvestris* (Lepeletier) (BB, RW), *B. vestalis* (Geoffroy *in* Fourcroy) (BB, RW, SC), *Apis mellifera* Linn. (BB, RW, SC, TE).

ENTOMOLOGICAL REPORT: DIPTERA (TIPULOIDEA AND EMPIDOIDEA)

ROY CROSSLEY

Introduction

The last Report under the above heading was published in 2001 (*Naturalist* **126:** 193-196). Since then Derek Whiteley has kindly sent me a comprehensive set of dolichopodid records from the Sheffield Museum database and Andy Godfrey has loaned a substantial number of site reports and details of identifications he has undertaken in the past ten years or more. I have been able to extract much information for the Y.N.U. records from these two sources, and I am grateful to both colleagues for their support. Records have also been received from J. D. Coldwell, J. H. Cole, W. R. Dolling, C. M. Drake, W. A. Ely, A. Grayson, I. Perry, A. E. Stubbs and P. Talbot, to all of whom I express my thanks. The more significant ones are included in this Report; unattributed records are those of the writer. New County records are indicated by †, and Vice-County records by *.

National rarity classifications which follow, where appropriate, immediately after the species names are those provisionally recommended by Falk (1991) for Tipuloidea and Falk and Crossley (in prep.) for Empidoidea. The systematic order of the list, and nomenclature, follow Chandler (1998).

TIPULIDAE

**Nephrotoma cornicina* (L.) (63) Pot Riding Wood, 14/8/91 1 ♂. A. Godfrey. Apparently scarce in the County; the first record was from Bedale (VC65) 4/8/23 C. A. Cheetham, and then Barmby Moor (VC61) in August 1936 H. C. Audcent. The only subsequent records have been from High Batts Reserve and Nosterfield Reserve (both VC64), in 1996 and 1998 respectively, and in my greenhouse at Wilberfoss (VC61) 7/8/97.

*Tipula (*s.g. *Dendrotipula) flavolineata* Mg. A female seen ovipositing on a rotting log in a garden at Elland, bordering on Park Wood (VC63), by P. Talbot 15/6/02, was subsequently identified as this species (R.C.).

T. (*s.g. *Savtshenkia) grisescens* Zett. **RDB3 (62) A single ♂ Seivedale Fen (Dalby Forest), 11/4/02, and another single ♂ swept in a hillside flush at Fen Bog on the same date. There are about ten records for this early spring species during the 1930s and 40s, all in the far west of the County, and attributed to C. A. Cheetham. The only records since then have been from the Little Don Valley (VC63), on 12/4/97 (Crossley 1998 p.119) and 19/4/00, (both J.D.C.).

**T. (*s.g. *S.) subnodicornis* Zett. (62) Wheeldale Bridge, 19/4/02; Fen Bog, 23/4/02. Although a widespread species on the upland peat of the Pennines, these are the first records for the North York Moors.

T. (*s.g. *Schummelia) yerburyi* Edw. **Nb (62) Wheeldale Plantation, 21/6/02; Eller Gill (Fen Bog Reserve), 24/6/02. At both sites specimens were seen flying under overhanging vegetation on the banks of moorland streams. The only previous Yorkshire records are from Seckar Wood, Wakefield in 1943 and the Little Don Valley in 1998 (Crossley 1999 p. 84); it was found again in the latter site on 19/6/02 (J.D.C.). The male specimen on which the Seckar Wood record is based was collected by C. A. Cheetham and is in the Diptera collection at Leeds Museums Resource Centre where I examined it on the occasion of the Entomological Section annual meeting in October 2002.

LIMONIIDAE

**Erioconopa diuturna* (Walker) (62) Eller Gill, 19/9/02; Bonfield Gill, 27/9/02 and 18/10/02; in all cases swept ex *Juncus squarrosus* L. Examples of both sexes were abundant at Bonfield Gill on the first date and still present, but less abundant, in mid-October. There are numerous records for this autumnal species in the western half of the County, but none yet for VC61.

**Erioptera (*s.g. *Erioptera s.s.) verralli* Edw. (= *nigripalpis* of Goet.) RDB3 (61) Howl Beck Wood, Eddlethorpe, 8/5/02. This rare species is found along densely shaded streams with incised banks, almost exclusively on clay (Falk 1991). It is now known in Yorkshire from five sites, these being Ashberry, 8/6/80, P. Skidmore, Forge Valley Woods NNR, 31/5/96, (both VC62); Spring Wood, Rotherham, 10/5/77, Kennel & Gallery Bottom Woods, 27/5/82, (both VC63 and both W.A.E.).

Gnophomyia viridipennis (Gimm.) **Nb** (62) Lady Spring Wood, Malton, 9/6/97 and 28/8/97, around felled timber; (63) Sandall Beat Wood, Doncaster, 25/9/02 (1 ♂ on felled timber). The only other Yorkshire records are: Castle Howard (VC62) 3/7/26, F. W. Edwards, and Rainborough Park (VC63) 4/7/85, W.E.A.

Gonomyia* (s.g. *Gonomyia s.s.) conoviensis* Barnes **Nb (61) Sewerby Cliffs, 19/5/98; Reighton Cliffs, 19/6/01. The first Yorkshire record was from Mulgrave Woods (VC62) in August 1937, F. W. Edwards. Cheetham took it at Low Waters, Austwick two years later, and it was recorded in the 1950s in plantations at Malham Tarn (Henson, 1963) (both VC64). There was then a flurry of records from sites in vice-county 65 in the early 1980s, mainly as a result of work by visiting dipterists. At the present time the species is thus known in Yorkshire from coastal sites and in the hill country of the far west, with no records in between. This accords well with the national distribution statement in Falk (1991).

**G.* (s.g. *G. s.s.) dentata* de Meij. (62) Eller Gill, 11/6/02, 19/9/02; Howl Moor, 16/7/02; Keys Beck (Cropton Forest), 16/7/02.

Hoplolabis (s.g. *Parilisia) vicina* (Tonnoir in Goet. & Tonn.) (*61) Howl Beck Wood, 8/5/02; (*65) Risedale Beck, Catterick, 24/7/02. These records, the fourth and fifth respectively, indicate that this tiny fly is widely scattered, but very localised, in the County (see Crossley 2001 p. 193).

Idiocera (s.g. *Idiocera s.s.) bradleyi* (Edw.) **RDB2** (61) North Ferriby, 3/7/01 and 28/7/01. Several specimens found at cliff seepages at Redcliff on the Humber bank. For an account of this species, recently thought likely to be extinct in Britain, see Crossley, 1998, p. 121; its situation nationally is considered to be precarious (Falk 1991). It is unfortunate that a large colony of insectivorous Sand Martins has become established at this newly discovered site; as the birds are not likely to be selective in what they catch, they pose a potential threat to one of Britain's rarest insects.

Molophilus (s.g. *Molophilus s.s.) occultus* de Meij. (*62) Fen Bog, 17/6/02 and 5/8/02; (63) Park Wood, Elland, 8/6/02. There are only five other recorded localities for this species in the county, the earliest being from Austwick Moss (VC64) in 1921 (C. A. Cheetham), with the intriguing comment 'dancing in small swarms, 20 or so, all over'.

**Molophilus* (s.g. *M. s.s.) pleuralis* de Meij. (61) Kilnsea, 30/8/02, by wet scrapes in a field north of Warren Cottage. Other records of this species in Yorkshire are, with one exception, from the southern part of VC63.

M. (s.g. *M. s.s.) undulatus* Tonnoir in Goet. & Tonn. (*61) Howl Beck Wood, 7/8/02; (*63) Park Wood, Elland, 10/9/01. Widely distributed, but very localised in the County, and with no record yet for VC64

Rhabdomastix edwardsi Tjeder (*62) Littlebeck Wood, 1 ♀, 17/6/02; (64) Grass Woods, 1 ♀, 25/6/02; (65) Risedale Beck, Catterick, 1 ♂, 13/7/02. I am obliged to Dr J. Starý (Olomouc, Czech Republic) for kindly identifying my specimens. The only previous Yorkshire records are: Coverham, 23/6/24, F. W. Edwards, and Dent 3/6/33, C.A.C., with the comment 'plenty in dry river bed on solid limestone' (both localities are in vice-county 65); and Whitewell (VC64) 1 ♀, 16/6/62, A. Brindle.

**Tasiocera* (s.g. *Dasymolophilus) fuscescens* (Lacksch.) (63) Park Wood, Elland, 1 ♂, 6/6/01. *Tasiocera* are amongst the smallest flies in the family, and separation of the species is possible only by examination of male genitalia. The number of known British species has risen from one in 1951 to seven at present (Stubbs 2001). Elsewhere in Yorkshire *T. fuscescens* is only reported from five localities in VC65, all in June, 1981.

†*T.* (s.g. *D.) halesus* (Schmid) (62) Ashberry, 16/7/96, 1 ♂, *leg.* I.P., det.A.E.S. (Stubbs, 2001). This represents the first, and only, record for the British Isles.

Eloeophila apicata (Lw.) **Nb** (62) Littlebeck Wood, 22/7/02; (65) Risedale Beck, Catterick, 13/7/02. Both sites are wooded streamsides. For previous Yorkshire records of this scarce species see Crossley (1999 p. 84),

E. trimaculata* (Zett.) **Nb (62) Eller Beck (Fen Bog Reserve), 20/5/02; Wheeldale Plantation, 1/6/02.

*Neolimnomyia (*s.g. *Brachylimnophila) adjuncta* (Walker) *(61) by wet scrapes in a field north of Warren Cottage, Kilnsea, 13/9/02; (63) Park Wood, Elland, 1♂, 23/5/01. The only previous County records have been from four wetland/marsh sites in the Barnsley/ Rotherham/Doncaster triangle.

Phylidorea (*s.g. *Phylidorea s.s.) abdominalis* (Staeg.) **Nb (62) Fen Bog, frequent and widespread across the bog on dates ranging from 20/5/02-9/7/02. This appears to be a truly rare fly in Yorkshire, the only previous records being Austwick (presumably the Moss), 5/6/20, C.A.C., and Crag Wood (probably Adel), 9/6/20, C.A.C., where Adrian Norris tells me there is a *Sphagnum* bog, now scrubbed over, but open in the past. Both sites are in vice-county 64.

Pilaria fuscipennis (Mg.) **Nb** (*61) Howl Beck Wood, 15/6/02; (*63) Park Wood, Elland, 22/6/01, Drop Clough, Marsden, 27/8/02; (*64) Middleton Woods, Ilkley, 24/8/02. This species has also been found in four vice-county 62 sites in addition to the first two to be reported for Yorkshire (Crossley 1998 p. 121). Indications are that it will be found to be widespread across the county.

†*Dicranomyia (*s.g. *Idiopyga) melleicauda* ssp. *complicata* de Meij. **Nb** (61) Welwick, 18/7/02. Examples of both sexes were swept from amongst Sea Clubrush *(Bolboschoenus maritimus* (L) Palla) in a dyke behind the flood-bank of the salt-marsh. This species of coastal marshes is a gratifying addition to the list of Yorkshire diptera. Nationally there are records from about a dozen post-1960 sites in England, Scotland and Wales (Falk, 1991).

HYBOTIDAE

**Bicellaria subpilosa* Coll. (62) Fen Bog, 7/5/02; New Earswick, York, 4/7/02. There are few Yorkshire records of this northern species, all previous ones being in Pennine sites in vice-counties 64 and 65.

**Symballophthalmus fuscitarsis* (Zett.) (61) Howl Beck Wood, 3/7/02. The majority of records for this widespread, but local, species are in the northern half of the county.

EMPIDIDAE

Empis (*s.g. *Anacrostichus) lucida* Zett. (63) Outer Edge, Howden Moors 25/5/91. 1 ♂ taken from flowers of Cloudberry (*Rubus chamaemorus* L.), E. Smith det. A. Godfrey. It is interesting to note that, in his report on the 1921 Y.N.U. Whitsun meeting at Dent, Chris Cheetham, who was camping at Ribblehead 'with a small number of other members' (the main party were staying at the George and Dragon Hotel in Dent), noted that both this species and the closely related *E. verralli* were found on the summit of Whernside, and comments that these two are 'the species generally found in abundance on Cloudberry blooms' (*Naturalist* **46: 273, 1921).

**Empis (*s.g. *Platyptera) borealis* L (62) Wheeldale Plantation, 1 ♂ at sallow blossom, 19/4/02, 1 ♀ swept in nearby location, 25/5/02. The only previous Yorkshire record is Silverstone Plantation, Austwick (64), 18/5/33 (C. A. Cheetham). This large spring empidid has a typical 'Highland Britain' distribution nationally, and it has recently been shown to be common in southern Cumbria on areas of acid mossland (Sumner & Birkett 2002). It is the

commonest empidid in Scandinavia, though much more common in the colder central and northern parts of that region (Chvála 1994).

Chelifera subangusta Coll. (*61) Howl Beck Wood, 19/7/02. (*63) Little Don Valley, 30/8/00; Park Wood Elland, 23/8/01. A widespread, though local, species with reports from about a dozen localities across the county.

**Chelipoda vocatoria* (Fall.) (65) Foxglove Covert, Catterick, 24/7/02.

DOLICHOPODIDAE

Dolichopus (s.g. *Dolichopus s.s.) strigipes* Verr. **Nb.** (61) The first Yorkshire record for this southern salt-marsh species was from Welwick, where a single male was found on 19 July 1996 by Dr C. M. Drake (Crossley. 1999 p. 87). Despite numerous searches at Welwick, both before the discovery and after, the species remained elusive to me. However, persistence was rewarded on 18/7/02 when it was found to be numerous and widespread on the landward edge of the marsh close to the flood-bank. Both sexes were present, indicating a well-established population.

**D.* (s.g. *D. s.s.) urbanus* Mg. (63) Howden Moors and Cranberry Clough, July 1988 and 24/7/90 D. W. det A. Godfrey. This appears to be rather localised in Yorkshire, with previous records being from sites in the north and east of the county.

†*Poecilobothrus principalis* (Lw.) (61) A teneral ♂ was swept from vegetation close to the Humber shore near Warren Cottage, Spurn, 14/7/01. Two more males were swept, 26/7/01, from vegetation bordering wet scrapes in a field north of Warren Cottage. A search at the latter site in late August and mid-September 2002 failed to reveal further specimens, but those dates may have been too late.

†*Tachytrechus consobrinus* (Haliday in Walker) **Nb.** (62) Fen Bog, 24/6/02 and 9/7/02. Several examples of both sexes were found.

†*T. insignis* (Stann.) (61) Near Beacon Ponds, Kilnsea, 28/8/01, where several specimens of both sexes were found on wet sand bordering a drainage dyke.

**Hydrophorus albiceps* Frey (62) Fen Bog, 24/6/02 and 16/8/02. Usually associated with wet peat, this species is widely, but locally, distributed in upland Pennine sites. It has also been reported from the lowlands of Thorne Moors and Skipwith Common. This is the first record for the North York Moors.

Orthoceratium lacustre (Scop.) (61) This species, which is amongst the most handsome of the metallic dolichopodid flies, was first recorded in Yorkshire from the upper beach at Kilnsea in September 1999 (Crossley 2000 p. 140). A search in 2000 failed to reveal further specimens, the site having been destroyed by sea action. However, the species was rediscovered not far away at the wet scrapes in a field north of Warren Cottage, Kilnsea where examples of both sexes were found on 28/8/01 and again on 13/9/02.

†*Nematoproctus distendens* (Mg.) **RDB3** (63) Woodhouse Washlands, 1 ♂, 23/7/93, *leg.* D.W., det. A. Godfrey. Mostly found in the New Forest, and at three other sites in southern England; all British records are after 1962 (Falk & Crossley, in prep.)

**Rhaphium auctum* Lw. (63) Little Don Valley, 19/6/02; Park Wood, Elland, 8/8/02. Rather local in Yorkshire; there are still no records from vice-counties 61 and 65.

Syntormon monile (Haliday in Walker) Formerly known as *monilis*, records of this species are widespread, although localised, across much of Yorkshire, except for vice-county 65. For some time it was known that there were two species under this name, (P. J. Hodge, in *Empid & Dolichopodid Study Group Newsheet*, No. 12, August 1993), but it was not until 1995 that the matter was resolved when Mr.Hodge exhibited specimens of the 'new' species named *'silvianus'* Párvu, at the Annual Exhibition of the British Entomological and Natural History Society *(Br. J. Ent. Nat. Hist.* **9:** 231, 1996). The receipt of Párvu (1989), kindly presented to me by Mr C. E. Dyte, has enabled a check to be made of preserved specimens by myself and colleagues who have submitted records of *monile* in the recent past, and this, coupled with subsequent collecting, has shown that it is *silvianum* (spelling as in Chandler 1998), which is the species most usually found. In the absence of voucher specimens all previous records of *monile* should be disregarded; it is not possible to separate the females of the two species.

S. monile is now recorded authentically in Yorkshire from only one site: Seivedale Fen (Dalby Forest) (VC62), 15/7/96 I.P.; same locality 29/6/01 and 24/7/01.

†*S. silvianum* Párvu The distribution statement for this species in Yorkshire is that formerly of *monile*; that is, widespread across the county, but localised.

**Teuchophorus simplex* Mik (61) Howl Beck Wood, 19/7/02. Currently known from only six Yorkshire localities, *simplex* is the scarcest member of this genus of minute flies, which are usually found in the vicinity of streams.

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THE DISTRIBUTION OF THE SMALL PEARL-BORDERED FRITILLARY BUTTERFLY *BOLORIA SELENE*, IN YORKSHIRE VC65

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Introduction

The Small Pearl-bordered Fritillary, *Boloria selene*, was widely present over Eastern and Central Yorkshire up to the early 1900s but it has disappeared from south, south-east and central Yorkshire (Asher *et al.* 2001). Its status in western Yorkshire was relatively unknown until Whitaker (2002a) recorded it at several sites in vice-county 64 (Mid-West Yorkshire), on mires in the south-west of the Yorkshire Dales National Park (YDNP) and the Craven Lowlands. At this time its continued occurrence in VC65 (North-West Yorkshire) was in doubt.

Mainly Historical

Nineteenth century butterfly records are lacking from most of North-West Yorkshire. Even Porritt's great compilation and its supplement included only a handful of Lepidoptera records from Yorkshire west of Leeds (Porritt 1883, 1904) and do not include any VC65 or VC64, Argynnine records. In the west *Boloria selene* was unrecorded until the 1930s (Whitaker 2003 in press).

Until 1993 there were only three records in VC65; a pre-1900 record by Dr Lees in NZ01, Wooded banks at Cotherstone, Teesdale (Robson 1898), Peter Summers reported a single fresh male at Falcon Clints near High Force (NY82) on July 6 1977 and Dr Archie Heron recorded it near Aysgarth (SE07) in 1982 (Sutton & Beaumont 1989).

Current Situation in Yorkshire

In Yorkshire the species is now confined to three groups of sites (15 10 km squares). Its current stronghold is in seven 10 km squares (30 tetrads) of east Yorkshire on the North York Moors (VC62). There are two groups of sites in western Yorkshire, in the Craven Lowlands and the YDNP (VCs 64 and 65). Breeding sites are confirmed in five 10 km squares (13 tetrads) on rush pastures and mires in VC64 (Whitaker 2002a). A study for English Nature and the YDNP Authority, carried out in 2002, has confirmed sites in VC65 three 10 km squares (3 tetrads) in the Cumbrian part of the YDNP. These are part of a group of sites in the upper valleys of the Lune and its tributaries. (Whitaker 2002b unpubl.) (Fig. 1).

All the VC64 sites on the southern margin of the YDNP should be considered as an integral group extending into the Craven Lowlands associated with the upper Ribble Valley. Although on the 10 km square scale the VC65 sites in the YDNP may appear to be in close proximity to them, the two groups are separated by at least 15 km. None of the sites are part of a network; all are isolated with the exception of a single network of linked sites on Newby Moor SSSI which is probably the only functional metapopulation in West Yorkshire (Whitaker 2002a, 2002b unpubl.).

The VC65 Sites and Their Vegetation

The sites support NVC M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture and M6 *Carex echinata-Sphagnum recurvum/S. auriculatum* mire and their sub-communities in a small scale (often at metre scale) vegetational mosaic. The occurrence of nectar plants, especially common in NVC M23, near to the foodplant locations and the tussocky nature of the mosaic vegetation are probably important factors in making the habitat suitable for *B. selene*. Tussocks of *Molinia, Deschampsia* and *Polytrichum* probably provide sites above

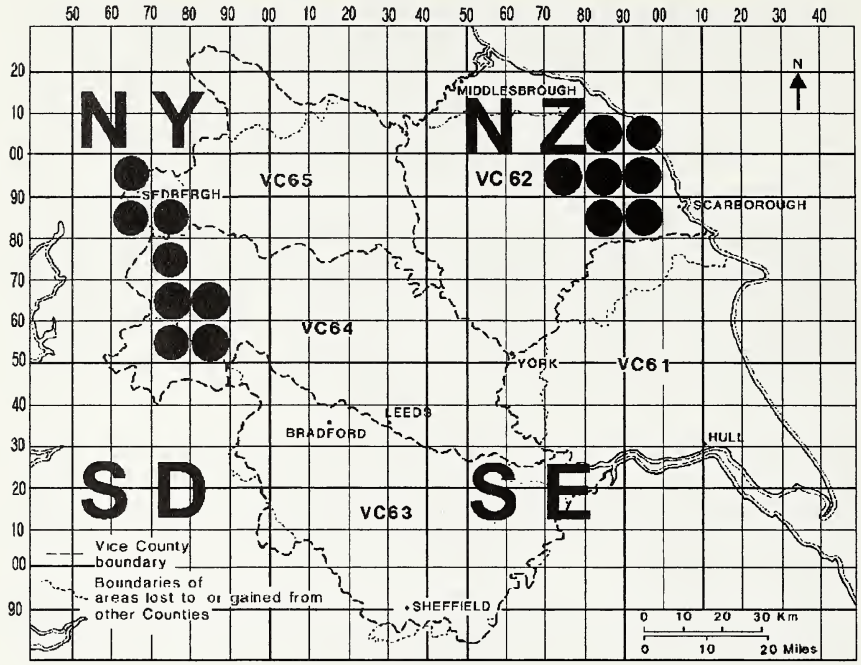

FIGURE 1.
The distribution of *Boloria selene* in Watsonian Yorkshire.

flood level and insulated from extremes of winter cold, for the torpid fourth instar overwintering larvae. The nectar-source most commonly used by the adults is Marsh Thistle, *Cirsium palustre*, which is found on all of the sites in VCs 64 and 65 where it is used almost exclusively, although Ragged Robin, *Lychnis flos-cuculi* and Cuckoo Flower, *Cardamine pratensis*, are also used. A single individual being observed on Bell Heather, *Erica cinerea*. In the 2002 study 13 individuals were recorded at nectar; 10 on *Cirsium palustre,* 2 *on Lychnis flos-cuculi* and 1 on *Cardamine pratensis* (Whitaker 2002, 2002b unpubl, 2003 in press).

26 Rise Hill, near Dent Station (SD766 887)
The south entrance portal of Rise Hill Tunnel on the Settle-Carlisle Railway line is sited in a steep south-facing slope with commercial coniferous plantations on three sides. This makes it unusually warm for its 380 m altitude. The site has *Viola palustris* in marshy runnels and *V rivineana* widely distributed in drier areas. and it supports a mosaic of small habitat patches with a few willow and hawthorn shrubs. The north-west side is dominated by Purple Moor Grass, *Molinia caerulea*, with a heathy patch dominated by *Calluna vulgaris* and occasional Bilberry, *Vaccinium myrtillus* (NVC H12?), above the tunnel mouth. Very small patches of *Holcus lanatus-Deschampsia cespitosa* (MG9?) grassland are also present. *Viola riviniana* occurs locally but abundantly around some smaller patches of neutral grassland and is accompanied by *Primula veris* and *P. vulgaris* especially in small areas of willow woodland found on the steeper embankments. *Viola palustris* occurs abundantly on the east and west sides in marshy runnels and bankside drains adjacent to the

TABLE 1A.
Bolonia selene sites in VC65.
Occupancy confirmed on three sites in 2002 (after Whitaker 2002a & 2002b unpubl.).

Site No.	Site No.	Height (metres)	Trees	Wetness	Foodplant	Total site Area (ha)	Area with violets (ha)	Mean % *V. palustris*	Isolation 1 (Km)	Isolation 2 (Km)	NVC Type
26	Rise Hill Tunnel East Portal	320-370	1	1	*	<0.75	<0.3	2.0	8.1	8.3	M23a
	Rise Hill Tunnel West Portal				*	+ <0.2**	<0.2	15.4%			M23b
27	Haw Gill, Combe Scar SSSI	272-284	0	2		3.0	21.4	10.0%	2.3	4.5	M6d
28	Helms Moss	248	0	3		0.6	<16	10.0%	2.3	8.3	M6
–	Near Aysgarth SE07	Site reported by A. Heron; exact location now lost (Sutton & Beaumont 1989)									
	Mean N = 3	**304**						**9.4%**	**4.2**	**7.03**	

Table 1b. Potential (unoccupied?) sites (cf. Appendix).

18	Locker Tarn	350	0	2		<4	<0.5	–			M23
27	Weather Ling Hill	240	0	2	*		<0.2	–			M23
29	Frostrow Fells	260	0				<0.1?	–			M6?
30	Stopes Moss	261	1	2		3+	<0.3	6.6%			M6
31	Longstone Fell – Tarn Hill	250-280	0				<.2?	–			M6 & M23

Key:
Foodplants
Blank = site with *V. riviniana* only *= site with both *Viola palustris* + *V. riviniana* ** = site with *Viola riviniana* only.
Trees on site 0 = No trees, 1= few isolated trees or bushes, 2 = Significant trees.
Site Wetness 0 = dry, 1 = damp, 2 = wet, 3 = Very wet.
Isolation 1 & 2 is the distance to nearest & second nearest sites.

forest and sparsely within the large area of dense and floristically extremely rich M23 (mostly M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture: *J. acutiflorus* subcommunity) on the eastern side. This vegetation has developed on limestone-rich spoil, with locally impeded drainage, derived from the railway tunnel. The recent (in the last 140 years), establishment of vegetation on this disturbed site was reflected by botanical quadrats which showed a wide variety of NVCs when diagnosed individually by MATCH (Whitaker 20002b unpubl.). The area of tussocky *Molinia caerulea-Potentilla erecta* grassland on the north-west of the site is probably a relict of the original (19th century) vegetation of the area. Roe deer regularly graze this site.

Notable plants recorded in the M23 areas of the site include Greater Butterfly Orchid, *Platanthera chlorantha*, Lesser Twayblade, *Listera cordata*, Frog Orchid, *Coeloglossum viride*, and Adders' Tongue, *Ophioglossum vulgatum*.

27 Haw Gill, (Combe Scar SSSI) Dent (SD679 876)
Haw Gill drains to the north through the SSSI which is a complex of upland habitats and plant communities fed by several acidic and basic flushes under the precipice of Combe Scar. Marshy grassland alongside the stream is NVC M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture and M6 *Carex echinata-Sphagnum recurvum/S. auriculatum* mire is the main habitat for the *Viola palustris* food-plant. This is mainly the *Juncus acutiflorus* sub-communities of M23a and M6d (Fig. 2). There is further M23 habitat to the north and west near of some NVC M10 *Carex dioica-Pinguicula vulgaris* flushes at SD678878 where *Primula farinosa* is locally common. *V. palustris* is found sparsely but

widely on other parts of the site where *Juncus* rush pasture forms a mosaic with M25 *Molinia caerulea-Potentilla erecta* mire and M6 *Carex echinata-Sphagnum recurvum/S. auriculatum* mire. To the east, near to Combe House at SD680875 (just outside the SSSI), is more M23 *Juncus effusus* rush pasture.

A global positioning system was used in conjunction with the GPS Utility computer programme to map the distribution of the *Viola palustris* on this complex site (Fig. 2).

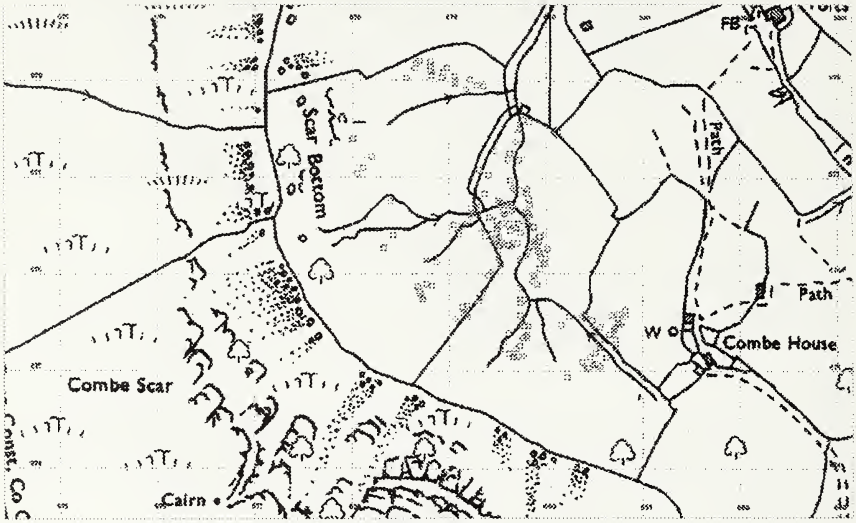

FIGURE 2.
A GPS plot of *V. palustris* distribution at Combe Scar SSSI.

28 Helms Moss, Gawthrop, Dent (SD683 900)
Originally this was an extremely wet site, probably a large S9a *Carex rostrata*-swamp. Major and catastrophic drainage of the moss has taken place by the cutting of large trenches across the site and the stream in Helmside Gill has been deepened by up to 2 m. This has had the effect of confining the *Carex rostrata* vegetation (now NVC M5) to the central area and the drainage channels but has benefited the M23 and M6 vegetation communities on its margins where most of the *Viola palustris* plants are found.

28a Lower Helmside Gill, Dent (SD685 899)
Downstream from Helms Moss the NVC M23 vegetation extends as a narrow marginal strip between SD684899 to SD687897 alongside the deepened stream.

CONSERVATION
The butterfly has survived on many of these sites by 'benign neglect'
No sites are specifically managed to conserve or encourage *Boloria selene* but certain incidental aspects of management have preserved the species.

General measures required to protect existing populations
Management should be aimed at encouraging the Violet foodplants and preserving adjacent areas of nectar plants in a small scale mosaic of plant communities. *Viola palustris* needs a prolonged growing season free from drought and competition with rank vegetation.

Currently there is virtually no grazing at Rise Hill except by Roe Deer and Brown Hare. Sheep graze on Combe Scar SSSI and Helms Moss, and light grazing from time to time, especially in the Winter, helps to prevent *Juncus* and grasses from becoming tall and rank. Grazing produces a more open sward structure suitable for the violets and occasional light poaching by cattle is reputed to benefit Marsh Violet. However excess grazing can destroy the food plant and a sites suitability for the butterfly (Whitaker 2002a).

As well as obvious destruction by new roads or buildings, development risks include pipelines and cable trenches for utilities. Statutory authorities, utilities and contractors should be appraised of site locations and any necessary work should be planned appropriately to minimise the risk of damage (Whitaker 2003 in press).

Small, isolated populations are most at risk from casual extinction and failure to recolonise. All the VC65 sites are isolated (Table 1a) and populations are probably small. These stochastic risks are quantified by Hanski (1991).

Management Recommendations

Prevent damaging operations such as:

1) Application of any fertilisers or pesticides.
2) Inappropriate grazing regimes, especially overgrazing by sheep.
3) Drainage.
4) Abandonment.
5) Development.

Conservation aspects of management are discussed in more detail in Whitaker (2002b unpubl., 2003 in press). The risks especially relevant to the three VC65 sites are discussed in more detail below.

Rise Hill

A watching brief on the possible development of scrub on Rise Hill should be adopted. On non-agricultural sites such as those owned by Network Rail this can only be addressed by cutting the vegetation occasionally. Herbicide is regularly sprayed adjacent to the tracks of the Skipton to Settle Railway Line and the Settle-Carlisle Railway Line. In 2002, badly adjusted equipment or spraying under unsuitable conditions resulted in the destruction of florally rich vegetation on large areas of the embankments in excess of 3 m from the track and this caused impoverishment of nectar sites for butterflies.

Helms Moss

Ironically the deep drainage cut on the south of the site has acted as a barrier, preventing sheep from easily penetrating onto the majority of the mire and although the vegetation has suffered from the drainage, grazing is probably fairly optimal at present. Any alteration of drainage is unlikely to be beneficial.

Combe Scar

This is one of the few west Yorkshire sites where significant drainage has not occurred and grazing is probably near optimal. However ownership of the site has changed recently and this has resulted in the rebuilding of Combe House. Unsympathetic gardening which has been rife in other parts of the YDNP could affect the parts of the habitat outside the SSSI.

Acknowledgements

As well as English Nature and the Yorkshire Dales National Park Authority who helped fund this study, I would like to thank Butterfly Conservation (including Butterfly Conservation, Yorkshire Branch) for access to butterfly record data, Judith Allinson for helping with the NVC field work, Paul Evans of English Nature and Tim Thom and Ian Court of the YDNPA for access to background information and site maps, and John Mounsey and Peter Summers for sharing site information.

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Appendix Potential Sites in VC65

Other small sites with a potential for the species are to be found in the area between Dentdale and Garsdale; these could form network with Helms Moss, Stopes Moss and the several small sites scattered on Frostrow Fells, Longstone Fell and Tarn Hill (Table 1).

Elswhere the following potential sites have been noted:

18 Locker Tarn (Lovely Seat/Stainton SSSI), near Carperby (SE 001917)

This is part of the extensive Lovely Seat – Stainton SSSI sometimes referred to as Lingy Pasture. There are *Carex-Pinguiculo* flushes feeding streams which meander through extensive M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture which has very high local densities (<40% cover) of Marsh Violet.

18a Near Locker Tarn (SE002914)

A small patch of degraded rush pasture with sparse *Viola palustris*.

27a Weather Ling Hill, Barbondale (SD6887)

On the north-east slopes of Weather Ling Hill is sparse scrub Hawthorn and sparse *Viola riviniana*. On the lower slopes is marshy rush pasture with various springs and flushes Drainage channels are cut down slope passing through areas of *Juncus acutiflorus* containing *V. palustris*. These all appear to be suitable habitat patches not far from the Combe Scar SSSI colony.

1) Flush at SD683870 runs into M23 rush pasture. *Viola palustris* <4%.
2) Flush at SD683872 *V. palustris* <3% (mainly near drainage channel).
3) Flush at SD683872 Includes *Sphagnum* tussocks (mainly *Sphagnum recurvum*) with local *Pinguicula vulgaris* (*Viola palustris* <2%).
4) Flush at SD683873 with *V. palustris*

29 Upper Helmside Gill, Frostrow Fells (SD683903, alt. 260 m)

This is the western feeder stream for Helms Moss. At its head is a small area of rush pasture with *Juncus effusus* and *V. palustris*

30 Stopes Moss, Dent (SD691896, alt. 260-262 m)
This shallow hollow contains a mosaic of habitats including heath communities and a central patch of mire communities surrounded by *Molinia* grassland. It originally drained naturally to the South, into Lower Helmside Gill but the stream has been deepened and culverted and drainage has been diverted from its northern margin along a valley under Long Moor to discharge into Helms Moss. This has resulted in the area of *V. palustris* habitat being drained by over 2 m and the mire being effectively split into northern and southern patches. Headward erosion of the northern ditch could further drain the mire. Prevention of this is essential. Gradual blocking of the southern drainage outlet could be of benefit. Near the outflow of the southern patch are a few sizeable Hawthorn and a few small Sallow bushes, the only trees on the mire.

30a to the west of Stopes Moss (SD689896, alt. 265 m)
A small area of *V. palustris* in *Juncus acutiflorus* surrounded by open *Molinia* grassland.

31 Longstone Fell-Tarn Hill (SD9068-SD9069)
Several small mires with *V. palustris* exist in the catchment of Holebeck Gill.

J. Mounsey and P. Summers have suggested that other sites may be present in Upper Garsdale these include: Holmes Moss Area and Caphill Moss, Baugh Fell but these await investigation.

BOOK REVIEWS

Imaging Wild America by **John R. Knott**. Pp. xvi + 234. University of Michigan Press, Ann Arbor, 2002. £39.00 hardback, £16.50 paperback.

The author, a Professor of English at the University of Michigan, after being profoundly affected by his own wilderness experiences in Alaska and Ontario, turned from his study of the Puritan texts of 16th and 17th century England to teach a course on the North American literature of wilderness. He chooses six writers whose influence he considers to have been particularly important, and discusses their lives and work, their relationship with their societies, and the way in which they perceived wilderness, wildness and primitiveness. The publisher describes the book as "a contribution to the growing literature of ecocriticism".

After a somewhat autobiographical Preface describing the author's entry to this new field, an Introduction offers a brief history of the American idea of wilderness from the feelings of the early European settlers that the wilderness was "hideous and desolate" and a "frightening and disorienting place of evil" through to John Muir's quasi-mystical description of the Sierra as a "range of light", and a "divine wilderness" and Henry David Thoreau's statement "In wilderness is the preservation of the world".

This is followed by six essays on the life and work of those writers whom Knott deems most influential of this genre. First discussed is John James Audubon, protoconservationist, ornithologist and artist (1785-1851), a somewhat enigmatic character, who periodically reinvented himself, claiming friendships he never had, as he transformed the persona of the woodsman into that of one at ease in the salons of educated Europe. This is followed by an account of Henry David Thoreau (1817-1862), an early expositor of the meaning of wilderness and wildness in American life, who was profoundly influenced by Audubon. The next essay on John Muir, originally from Scotland (1838-1914), ably conveys the "joy and rapture" found in the mountains and forests of the American West. Three more recent figures complete the set of case studies: Edward Abbey, whose spiritual home was the canyon country, Wendell Berry who "commands attention as a passionate and eloquent defender of agriculture at a human scale" and poet Mary Oliver.

A concluding chapter discusses relationships between these writers and the societies in which they lived, and explores the theme of wild nature and wilderness in American life and thought.

English readers will make comparisons with their own nature literature, which is very different in its emphasis and feel. The gentle writings of Gilbert White and Richard Jefferies express the notion of an Arcadian countryside in which human activities and nature blend into a seamless whole, rather than a wilderness that stands apart from humanity.

Although this is a very scholarly book – 25 pages of bibliographic and other notes complete the work – it is well-written, straight from the heart, and accessible. It is excellently produced. I liked it.

PHA

The Phytoplankton of Windermere (English Lake District) by **C. S. Reynolds** and **A. E. Irish**. Pp. 73, with 18 colour and 4 b/w illustrations. Freshwater Biological Association Special Publication no. 10, Ambleside LA22 0LP. 2000. £20.00 softback (including postage).

I read this book with a great deal of interest, since long-term series recording biological data for particular ecosystems are rare. In the United Kingdom, arguably the best of the continuous sets is for Lake Windermere, which owes its existence to the Freshwater Biological Association based there for 70 years.

This book contains much data on the phytoplankton populations and their changes with time and charts the biological responses to changing environmental conditions, such as increasing nutrient levels. The early chapters outline the background to this work and include details of the physical and chemical parameters of importance illustrated with colourful time/concentration/season graphs that clearly show the main changes.

Details of the phytoplankton species are then presented, together with population trends for the period 1965-1991. These are also illustrated in a similar way, clearly showing both seasonality of species and longer term trends, especially before and after control of phosphorus loadings. It is a fascinating story and includes the impacts of long-term climatic changes.

There are excellent colour photographs of the main species by Hilda Canter-Lund to complement a very useful text, bringing together a distillation of many years research. It is a must for all those studying freshwater ecology – the only drawback is the price, based no doubt on the need to include colour illustrations.

EB

British Geological Society Sheet Explanations providing concise accounts of the geology shown on the relevant 1:50 000 series geological maps have been published in 2002 for the following districts: Alresford, Bristol, Guildford, Kilmarnock and Loughborough. Each of these A5-sized booklets (30-34 pp.) includes colour photographs and diagrams and cost £9.00 (some are available as a pack with the accompanying series map at a special price of £18) from BGS Sales Desk (0115 936 3241) or online: www.geologyshop.com

OBITUARY

ATHOL JOHNSTON WALLIS (1919-2002)

I first met Athol Wallis on Scarborough South Pier in October 1959 when he came to see a small group of pioneer 'pelagicals', as we embarked in a motor coble skippered by the late 'Blondie' Wood, one of several such sea-watching trips I organised around that time. This meeting was the start of a friendship which lasted until his death. In May 1967 he joined a group of Yorkshire birders on a trip to Yugoslavia and subsequently visited France, Germany, Sweden, Switzerland and Iceland. Together with our wives, he and I visited Majorca in May 1980. By current standards, not a well-travelled man; he had no desire to go globe-trotting in search of birds, preferring to study all aspects of natural history in his beloved Scarborough district. His observations on seabirds along the Yorkshire coast from 1946-1951 are liberally sprinkled throughout Ralph Chislett's *Yorkshire Birds*, published in 1952, and he was a regular contributor to the *Yorkshire Bird Report* for many years thereafter.

His love of the countryside was fostered by his grandfather and his father Edward Arnold Wallis, who was a member of the Scarborough Field Naturalists' Society from 1890 to 1954. Although primarily an ornithologist, as was his father, Athol grew up in an age when the 'tunnel-visioned' pursuit of birds to the exclusion of all else was rare; with his father's guidance, he acquired a sound working knowledge of several other orders including geology, botany, entomology and conchology, making him one of those increasingly rare animals with a legitimate claim to be called an all-round naturalist.

Born into a Quaker family on 14th April 1919, he was educated at Scarborough's Gladstone Road School, the Boys' High School and finally at Ackworth Quaker School where he was an active member of their Natural History Society. On leaving school in 1936, he took a job as office junior in the counting house of W. Rowntree and Sons Ltd. in Westborough, Scarborough progressing to become office manager, assistant secretary,

company secretary, finance director and, finally, a member of the board of directors which took the decision to join the Debenhams group in 1966, staying with the company until his retirement in 1991. His links with the firm were maintained as pensions adviser for retiring staff until 1998.

At the outbreak of the Second World War, he registered as a conscientious objector and served for six years in the Friends' Ambulance Unit, working in London and Glasgow. At Glasgow he met Hannah Thompson, who was in charge of hospital catering and who had also attended Ackworth Quaker School. They married in Penrith, Hannah's home town, in 1946 and returned to live in Scarborough, where he joined the Field Naturalists' Society. He was soon to make his mark and went on to hold many important posts: Chairman of the publications committee in the early 1950s, responsible for the production of two volumes on the Flora and Fauna of the Scarborough District, published in 1953 and 1956; President for four terms (1959-1960, 1963, 1972-1974 and 1989-1990); Honorary Secretary (1949-1953); Librarian (1979-1984); Treasurer (1987-1997); Recorder for Ornithology for 49 years, for Conchology and Woodlice for 43 years and a Committee member for various terms totalling 12 years, thus being in continuous office for 50 years. He was made an Honorary Life Member of the Society in 1981. His collections of natural history specimens, mainly conchological and started by his father, are housed at the Wood End Museum in Scarborough. His library was extensive, many books having been handed down through his family, and he was proud to possess a complete run of Collins New Naturalist series.

He was a popular lecturer, particularly on the natural history of the Yorkshire coast and, in the 1970s, ran a series of weekend courses on ornithology at Hackness Grange on behalf of the North Yorkshire County Council. From 1949 to 1998, he contributed a very popular weekly 'Country Diary' for the Scarborough *Mercury*, even posting his reports from abroad when on holiday and, on his retirement, was honoured with a presentation and a tribute in the press for this long-standing commitment.

He joined the British Trust for Ornithology in 1948, remaining a member until 1998. During this time he served for several years as their representative in north-east Yorkshire and was involved with the pilot scheme for their *Breeding Atlas* in the early 1960s.

His association with the Yorkshire Naturalists' Union began on 6th June 1952 when he was accepted as a member at a meeting at Loftus in Cleveland, being proposed by E. F. Gilmore and seconded by H. Rowntree. During a long involvement with the Ornithological Section, he served on several committees and held important administrative posts: Ornithological Recorder for Vice-County 62 (1954-1966); member of the Records Committee (1954-1991); their Secretary and Treasurer (1970-1991) and General Secretary of the Section (1972-1976). He was elected President of the Union in 1971 and was made an Honorary Life Member in 2001. At the end of his Presidential year, when he was to deliver his Address on the 'Birds of the Yorkshire Coast' at the Annual General Meeting, he arrived to discover that he had left his slides at home but, being the accomplished orator that he undoubtedly was, proceeded to give it from memory, a feat which won him the approbation of all those present.

When writing *The Birds of Yorkshire* in 1984, I asked Athol to contribute a chapter on The Development of Ornithology in Yorkshire, which he kindly agreed to do, and he also wrote the Foreword for my *Where to Watch Birds in Yorkshire* in 1996.

As a Quaker, he sat on several committees of the Society of Friends and was treasurer of Ravensworth Lodge, its retirement home in Belgrave Crescent, Scarborough where he spent his final years. He died peacefully on 16th December 2002.

Athol Wallis was a very gentle man with a most engaging manner and was, for many years, so much a part of Yorkshire Ornithology that his passing, at the end of a long and fruitful innings, will be much mourned; he will be sadly and genuinely missed by all who knew him. He and Hannah, who died in 1985, had no children and he is survived by his brother Oscar and his sister Ruth to whom heartfelt sympathies are extended.

John R. Mather

ENTOMOLOGICAL REPORTS FOR 2000-2002, COLEOPTERA: STAPHYLINIDAE (ALEOCHARINAE)

M. L. DENTON

This is the first report to document the Aleocharinae of Yorkshire since that which appeared in 2000 (*Naturalist* **125**: 71-75). In keeping with recent Aleocharinae reports, the species' national status, as documented in the Joint Nature Conservation Committee publication *A review of the scarce and threatened Coleoptera of Great Britain, Part 2,* has been indicated. The definition of status categories attributed to these species are as follows:

1) NOTABLE A – thought to occur in 30 or fewer 10 km squares of the National Grid or, for less well-recorded groups, within seven or fewer vice-counties.
2) NOTABLE B – thought to occur in between 31 and 100 10 km squares of the National Grid or, for less well recorded groups between eight and twenty vice-counties.
3) NOTABLE – estimated to occur within the range of 16 to 100 km squares of the National Grid; subdivision this category into Notable A and Notable B has not been attempted.
4) INDETERMINATE – considered to be Endangered, Vulnerable or Rare, but there is insufficient information to say which of these categories is appropriate.
5) INSUFFICIENTLY KNOWN – taxa with very few known localities, but which belong to a poorly recorded or taxonomically difficult group.

For reasons described in the first Aleocharinae report (*Naturalist* **111**: 91-96), the sex of the specimen(s) on which identification was based has been indicated; it can be assumed that all specimens were male, unless otherwise stated.

In the past VC65 has been under worked, not only for its Coleoptera fauna, but for most other natural history groups. During 2002, however, R. J. Marsh visited the area on a number of occasions and his efforts added considerably to the known Yorkshire distribution of a number of species.

I would like to take this opportunity to thank the small number of dedicated collectors and identifiers for their continued support in documenting the Aleocharinae of Yorkshire. The following initials appear in the list that follows: LA = L. Auckland; JSD = J. S. Denton; MLD = M. L. Denton; WRD = W. R. Dolling; MH = M. Hammond; CJ = C. Johnson; RGL = R. G. Loxton; RJM = R. J. Marsh and EJS = E. J. Smith.

New county record. * New vice-county record.

Gymnusa variegata Kiesenwetter. (*61) Eastrington (SE72), not sexed, 30/9/00, in *Sphagnum*; MH det. MLD. (*65) Langthwaite (NY90), not sexed, 6/7/99, in wet pond litter; JSD. The other Yorkshire records of this Notable species are from VCs 62 and 63.

Oligota apicata Erichson. (*61) Danthorpe (TA23), not sexed, 31/7/01, tree stump with bracket fungi; WRD (teste MLD). Brook Farm, Elstronwick (TA23), not sexed, 4/10/01, in decaying wood; WRD (teste MLD). (*65) Magdalen Wood (SE27), not sexed, 1/7/02, woodland floor litter; RJM. Sharow Mires, Ripon (SE37), 6/8/02, under bark; RJM. The only previous records are from Scarborough (TA08) on an unrecorded date (early 20th century), Whitby (NZ81) in 1935, Anston Stones Wood (SK58) in 1935 and 1985, Morton Wood (SE10) in 1985 and Askham Bog (SE54) in 1996. This Notable species is confined to England and south-east Scotland where it is found in woodland and pasture-woodland. The species is possibly a predator of *Cis* (Coleoptera: Cisidae) and mites (Acari).

Oligota punctulata Heer. (*65) Marfield Fen (SE28), 8/6/02 & 12/9/02, in litter under Alder *Alnus glutinosa*; RJM. Magdalen Wood (SE27), 1/7/02; RJM. Sharow Mires, Ripon (SE37), 6/8/02, under bark; RJM.

Myllaena infuscata Kraatz. (*65) Marfield Quarry, Masham (SE28), female, 17/6/02, ground litter; RJM.

Myllaena kraatzi Sharp. (*63) Potteric Carr (Loversall Delph) (SE50), female, 23/4/02, in *Phragmites* litter; RJM. This species is afforded Notable status and is found in bogs and marshes.

Myllaena minuta (Gravenhorst). (*65) Marfield Fen, Masham (SE28), 8/6/02, in litter under Alder *Alnus glutinosa*; RJM. Marfield Quarry (SE28), 12/9/02, in carrion; RJM.

Gyrophaena gentilis Erichson. (*65) Sharow Mires, Ripon (SE37), 14/7/02, debris under poplar *Populus* bark; RJM. Magdalen Wood (SE27) 26/9/02, in gill fungi; RJM.

 # Gyrophaena joyi Wendeler. (64) Willow Garth, Ripon (YWT reserve) (SE37), 26/6/02, in fungi on Crack Willow *Salix fragilis*; RJM (teste MLD). (65) Sharow Mires, Ripon (SE37), 6/8/02, fungi under bark; RJM. The species is associated with wetlands and marshy habitats and has previously been recorded from southern England (north to north Wales) and north-west Scotland. It is afforded Notable status.

Leptusa fumida Kraatz. (*65) Sharow Mires, Ripon (SE37), 6/8/02, debris under poplar *Populus* bark; RJM.

Bolitochara bella Markel. (*61) Brook Farm, Elstronwick (TA23), 5/6/01, in *Daldinia* on Ash *Fraxinus excelsior* branches; WRD (teste MLD). The only previous records are from Malham (SD86) in 1957 and Lepton Great Wood (SE11) in 1985.

Autalia impressa (Olivier). (*65) Magdalen Wood (SE27), 1/7/02 & 26/9/02, in gill fungi and litter on woodland floor; RJM. Marfield Fen, Masham (SE28), 12/9/02, in litter under Alder *Alnus glutinosa*; RJM.

Autalia longicornis Scheerpeltz. (*65) Magdalen Wood (SE27), 26/9/02, in decaying gill fungi; RJM.

Gnypeta rubrior Tottenham. (61) Beacon Ponds (TA41), both sexes, 1/8/01, on the muddy margin of a brackish pond; WRD det. MLD. The only previous records are from Robin Hood's Bay (NZ90) in 1935, Spurn (TA41) in 1949, Blackmoorfoot (SE11) in 1984, Langsett (SE20) in 1987 and Rudston (TA16) in 1989.

Callicerus rigidicornis (Erichson). (*61) Manor Farm, Eddlethorpe (SE7766), both sexes, 2000/2001, pitfall traps; RGL det. MLD.

Amischa decipiens (Sharp). (*65) Marfield Fen, Masham (SE28), females, 8/6/02 & 12/9/02, in litter under Alder *Alnus glutinosa*; RJM.

Amischa forcipata Mulsant & Rey. (*64) Nicholson's Lagoons, Ripon (SE36), both sexes, 16/9/02, general sweeping; RJM.

Dadobia immersa (Erichson). (*61) Brook Farm, Elstronwick (TA23), not sexed, 25/5/01, in vegetable refuse; WRD (teste MLD). There are nine other widely scattered Yorkshire records of this species which is normally found under bark in woodland. The vegetable refuse in which the specimen was located was situated in a hedge and it had presumably originated from there.

Liogluta oblongiuscula (Sharp). (*65) Marfield Quarry, Masham (SE28), 17/7/02, general sweeping; RJM.

Atheta volans (Scriba). (*65) Foxglove N.R., Waithwith (SE19), 13/7/02, lake side debris; RJM.

Atheta indubia (Sharp). (*65) Sharow Mires, Ripon (SE37), females, 27/6/02 & 6/8/02, fungi under poplar *Populus* bark and in the remains of a dead cow; RJM.

Atheta taxiceroides Munster. (63) T. P. Wood, Marsh (SE11), 5/10/01, in *Amanita muscaria*; MLD. The only previous records are from Woodhouse Plantation (SE98) in 1995, New House Wood (SE20) in 1998, Toftwood, Rivelin (SK38) in 1998 and Molly Carr Wood (SE11) in 1999.

Atheta dadopora Thomson. (*65) Nosterfield Quarry (SE28), 29/5/02, in a dead bird; RJM. Marfield Quarry, Masham (SE28), 12/9/02, in a dead bird; RJM.

Atheta sordidula (Erichson). (*65) Magdalen Wood (SE27), both sexes, 1/7/02 & 26/9/02, in decaying gill fungi and horse dung; RJM.

Atheta incognita (Sharp). (62) Long Grain, Wykeham Forest (SE89), female, 5/6/00, males 18/6/00 & 20/8/00, all from flight interception traps; LA det. MLD. (63) Potteric Carr (SE50), female, 22/5/01, debris in *Phragmites* marsh; MLD. The only previous records are from Rivelin (SK28) in 1993, Ellers Springs (SE88) in 1995 and May Moss (SE89) in 1996.

Atheta xanthopus (Thomson). (*65) Sharow Mires, Ripon (SE37), female, 27/6/02, in the remains of a dead cow; RJM. Nosterfield Quarry (SE27), both sexes, 8/6/02, general sweeping; RJM.

Atheta basicornis (Mulsant & Rey). (*65) Sharow Mires, Ripon (SE37), female, 14/7/02, fungoid debris under poplar *Populus* bark; RJM. The only previous records are from Thorne Moor (SE71) in 1985 and Askham Bog (SE54) in 1996. This species, which is afforded Notable status, is restricted to wet habitats in England.

Atheta intermedia (Thomson). (*61) Spurn (TA41), 12/7/01, grass cuttings; MLD. The only previous records are from Malham (SD86) in 1954, Elland Park Wood (SE12) in 1985 and Swinden Plantation (SE10) in 1988.

Atheta laticollis (Stephens). (*65) Nosterfield Reserve (SE27), female, 8/7/02, general sweeping; RJM. Sharow Mires, Ripon (SE37), female, 6/8/02, under bark; RJM.

Atheta oblita (Erichson). (*63) Toftwood, Rivelin (SK38), female, 29/8/00; EJS (teste MLD). The only previous records are from Saltburn (NZ62) in 1897, Potter Brompton (SE97) in 1986 and May Moss (SE89) in 1996.

Atheta marcida (Erichson). (*65) Magdalen Wood (SE27), female, 26/9/02, in decaying gill fungi; RJM.

Trichiusa immigrata Lohse. (61) East Newton (TA23), 1/9/00; WRD det. MLD. McCann's Country Park (TA15), 12/9/00, old mowings; RJM. Brook Farm, Elstronwick (TA23), 20/9/00, compost heap; WRD det. MLD. Danthorpe (TA23), not sexed, 3/7/01, in grass pile; WRD (teste MLD) & 24/9/01, in horse dung; WRD (teste MLD). (63) South Hiendley Common (SE31), female, 6/4/00, in old hay; MLD. Blaxton Common (SE50), not sexed, 8/7/00, under straw bale; RJM. Woodhouse Mill Ponds, Deighton (SE11), female, 21/7/00, rotting vegetation; MLD. Hooton Pagnall Churchyard (SE40), 26/7/00, grass heap; RJM. Whiteley Wood (SK38), both sexes, 21/9/00; EJS (teste MLD). Cannon Hall (SE20), female, 11/8/01, grass mowings; RJM. (*65) Marfield Quarry, Masham (SE28), 17/7/02, swept from vegetation; RJM. This immigrant species was first recorded as British during 1992 when specimens were located in Kent (*Coleopterist*, **2** (1): 18), it had spread north to Leicestershire by the end of 1994 (*Coleopterist*, **4** (1): 14) and was first recorded in Yorkshire during 1996 (*Naturalist* **125**: 73). I know of no records north of the above mentioned.

Alianta incana (Erichson). (*65) Hall Garth Ponds, Ripon (SE37), not sexed, 7/8/02 & 9/9/02, in *Phragmites* litter; RJM.

Pachnida nigella (Erichson). (*65) Hall Garth Ponds, Ripon (SE37), not sexed, 7/8/02, in *Phragmites* litter; RJM.

Ilyobates bennetti Donisthorpe. (*64) Hopewell Farm, Harrogate (SE35), both sexes, 6/00, pitfall traps; MLD. The only previous records are from Wheldrake (SE74) in 1979, Shirley Pool (SE51) in 1986 and Bubwith Bridge (SE73) in 1985, 1986 & 1993. The species is afforded Notable status.

Ilyobates propinquus (Aube). (*61) Manor Farm, Eddlethorpe (SE7766), both sexes, 2000/2001, pitfall traps; RGL det. MLD. The only previous record is from Rossington Bridge (SK69) in 1985. This species, which is afforded Notable status, is found in southern England. The above records being the furthest north that the species has been located.

Calodera nigrita Mannerheim. (*65) Marfield Quarry, Masham (SE28), female, 17/7/02, water edge litter; RJM. The only previous records are from Thorganby (SE64) in 1971, Bishop Wood (SE53) in 1983, Thorne Moor (SE71) in 1985, Rawcliffe Meadows (SE55) in 1997 and Scarborough (TA08) on an unrecorded date. This species, which is afforded Notable status, is confined to England where it is found in wetlands and marshy habitats.

Chiloporata longitarsis (Erichson). (*65) Marfield Fen, Masham (SE28), not sexed, 8/6/02 & 12/9/02, in litter under Alder *Alnus glutinosa*; RJM. Magdalen Wood (SE27), not sexed, 26/9/02, litter on woodland floor; RJM.

Meotica exilis (Gravenhorst). (*65) Hall Garth Ponds, Ripon (SE37), not sexed, 9/9/02, reed bed litter; RJM.

Deubelia picina (Aube). (63) Rivelin (SK28), 25/7/98; EJS det. MLD. Rabbit Ings (SE31), female, 27/6/02, in *Phragmites* litter; MLD. The first record pre-dates those published in *The Naturalist* **125**: 74 to become the first for VC63.

The only other records are from Collingham (SE34) in 1917, Duncombe Park (SE68) in 1987, Wheldrake Ings (SE64) in 1991 and Wintersett (SE31) in 1999 and 2000.

Oxypoda umbrata (Gyllenhal). (*65) Foxglove N.R., Waithwith (SE19), female, 19/5/01; WRD det. MLD. Willow Garth, Ripon (YWT reserve) (SE37), 24/6/02, flood refuse; RJM.

Oxypoda exoleta Erichson. (63) Sprotbrough (SE50), female, 13/7/90, reed litter in flood plain of River Don; RJM det. CJ. The only other records are from Lockwood (SE11) in 1948, Spurn (TA41) in 1950 & 1951, Sunk Island (TA21) in 1986, Aughton Ings (SE63) in 1988 and Rawcliffe Meadows (SE55) in 1997. The species is associated with rabbit *Oryctolagus cuniculus* burrows, but has been recorded from other habitats, and is afforded Notable status.

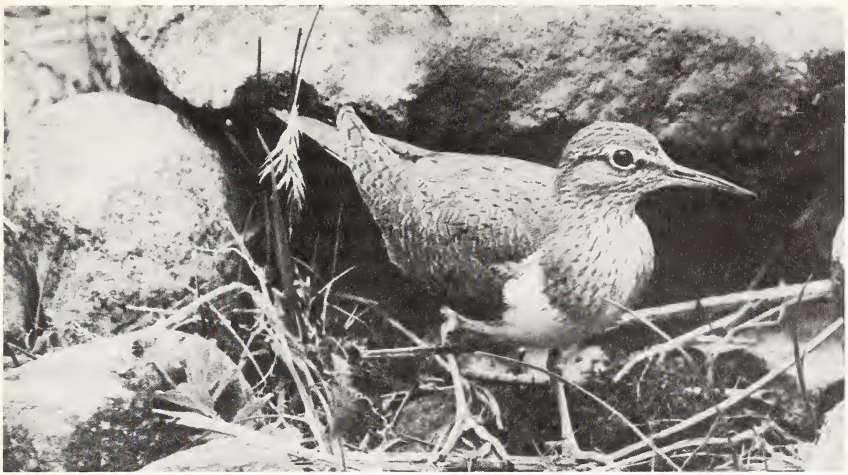
Oxypoda haemorrhoa (Mannerheim). (*65) Scorton Quarry (NZ20), 21/5/02, under straw bale; RJM. Marfield Quarry (SE28), not sexed, 8/6/02 & 17/7/02, water edge debris; RJM. Marfield Fen (SE28), not sexed, 12/9/02, in litter under Alder *Alnus glutinosa*; RJM.

Oxypoda opaca (Gravenhorst). (*65) Sharow Mires, female, 6/8/02, fungi under poplar *Populus* bark; RJM.

Crataraea suturalis (Mannerheim). (*65) Marfield Fen (SE28), not sexed, 12/9/02, in litter under Alder *Alnus glutinosa*; RJM.

Aleochara bipustulata (Linnaeus). (*65) Scorton Quarry (NZ20), female, 25/7/02, in the remains of a dead crow *Corvus*; RJM.

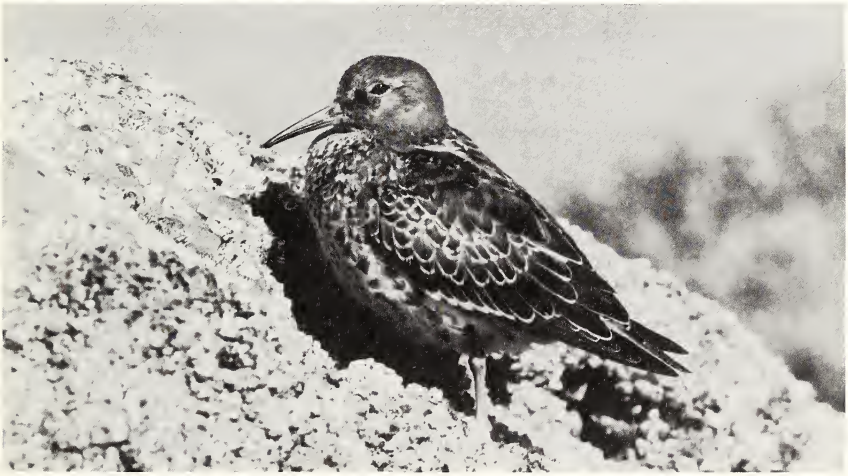
COMMON SANDPIPER



The Common Sandpiper (*Actitis hypoleucos*) is a regular summer visitor to Yorkshire's moorland streams, where it nests in a variety of situations along the banks. This bird, photographed in Dentdale in May, had laid its eggs under the shelter of a rock.

Photo: R. Vaughan

PURPLE SANDPIPER



The Purple Sandpiper (*Calidris maritima*) is a winter visitor to the Yorkshire coast, particularly favouring the Scarborough area and Filey Bay. Up to several hundred birds are usually present between April and September. This one was photographed in September on the rocks at Filey Brigg.

Photo: R. Vaughan

BOOK REVIEW

Windermere. Restoring the Health of England's Largest Lake by **A. D. Pickering**. Pp. 126, with 75 colour and b/w illustrations. Freshwater Biological Association Special Publication no. 11, Windermere LA22 0LP. 2001. £10.00 softback (including postage).

This volume celebrates the 50th anniversary of the formation of the Lake District National Park by tracing the history of Lake Windermere and its surroundings through its geological history to the present time.

Lake Windermere has been the centre of limnological research in the United Kingdom since 1931 when the Freshwater Biological Association was located there.

The author describes the geological and geographical development, the influence of changing climate, deforestation and, in recent years, the effects of increasing chemical nutrients in the water resulting from human activities, the latter affecting the health of the lake, causing changes to water quality and species changes such as possible threats to the Arctic Char (*Salvelinus alpinus*). The ecology of the lake, although complex, is described in simple terms which all can understand. The story is not all gloom as the last chapters look at the successful collaborative efforts of scientists and environmental managers to restore the lake to its former biological condition.

Although full of scientific detail, this book is very readable, with many helpful and beautiful illustrations. As a result it will be of equal interest to naturalists, tourists and the academic community; indeed, anyone just visiting the area will gain much by reading this book first.

EB

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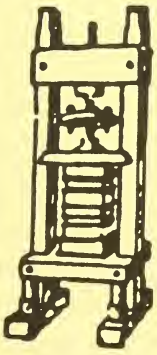

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July-September 2003 Number 1046
Volume 128

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Moths on the Move; The Colonisation of Yorkshire by Invading Micro-Lepidoptera – *Harry E. Beaumont*

The Wasps and Bees (Hymenoptera: Aculeata) of Messingham Sand Quarry in Watsonian Lincolnshire with Special Reference to Resident and Tourist Species – *Michael E. Archer*

The Aleocharinae (Coleopterae: Staphylinidae) of Yorkshire – *M. L. Denton*

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MOTHS ON THE MOVE: THE COLONISATION OF YORKSHIRE BY INVADING MICRO-LEPIDOPTERA.

HARRY E. BEAUMONT

Presidential address presented to the Yorkshire Naturalists' Union at Goole, 7th December 2002

Investigation of the distribution of animals and plants in Yorkshire, as elsewhere in Britain, has been a major component in the study of natural history subjects and one that has often been particularly the province of the amateur. Indeed our knowledge of the distribution of moths in Yorkshire, built up since the mid-eighteenth century, has relied almost exclusively on the work of amateurs. In earlier times, investigations were often undertaken alone but for upwards of a century and a half they came under the umbrella of local natural history societies or indeed of the Yorkshire Naturalists' Union itself. Initially, the accrual of distributional data was almost a by-product of the early lepidopterists' collecting activities. At that period of the 19th century literature was sparse, communication with like-minded enthusiasts could be difficult and travel was often limited to within walking distance of a collector's home.

Evidence of the difficulty of visiting some of the more remote collecting sites is contained in the diaries of Llewelyn Brady, a microlepidopterist who lived at Sheffield during the early years of the twentieth century. He records how on one occasion George Porritt travelled to Sheffield on the train from Huddersfield to spend a day collecting with him, they had visited Eccleshall Wood in the morning and intended to travel to the Sheffield moors at Strines in the afternoon. Unfortunately this proved not to be possible, for his diary records that there was a convention of clergymen in the town that day and they had hired all the horses, and he adds wryly, had drunk all the whisky!

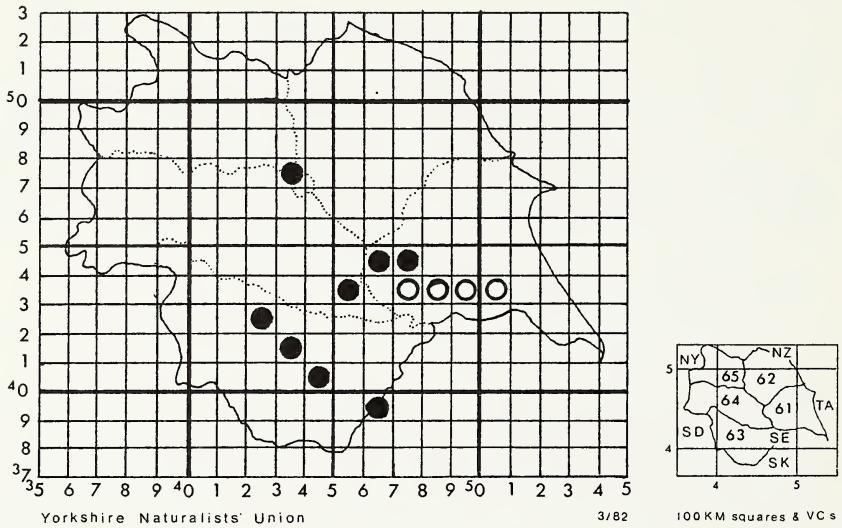
George Taylor Porritt commenced publication of his *List of the Lepidoptera of Yorkshire* in 1883, the first real assessment of the butterfly and moth fauna of Yorkshire as a whole. Even so his list was largely just that, a compilation of the known localities from which each species had been recorded within the county, with no attempt being made to define their geographical area of distribution. For many of the species this information was just not available, and indeed for many of the smaller moths this remains the case. Although it is now recognised that the distribution of insect populations, in common with those of other life forms, has never been static, the thinking at that time seems to have been that moths occurred at specific localities, as though their occurrence there was somehow set in stone. The discovery of any particular moth at a new site was treated as merely filling in the detail of a pre-existing distribution and at that time there appeared to be little concept of the moths themselves expanding or contracting their ranges. Although Yorkshire was at the forefront of investigation into the microlepidoptera in the middle of the nineteenth century, interest waxed and waned over the course of subsequent years and indeed there have been periods when little or no investigation of these smaller moths was taking place in the county. This lack of a continuous record limits the conclusions that can be drawn concerning changes in distribution during the first half of the twentieth century, but from the evidence available if such changes were occurring they were either imperceptible or unrecorded.

The causes of both contraction and expansion of the ranges of individual species are, at best, poorly understood. Furthermore it is sometimes difficult to know whether a newly recorded species is a recent arrival or whether it has merely been overlooked in the past. Nevertheless, the northward spread of a number of species into Yorkshire has been evident over the past 10-15 years, and perhaps even longer. Some of these have long been resident in southern England without having hitherto significantly extended their distribution northwards, while others have appeared in Britain as colonisers for the first time during the past 50 to 100 years and have in fairly recent times spread rapidly.

Of the many species of microlepidoptera that have expanded their range into the county

during the past twenty years, those that have shown the most dynamic movement receive more attention in this paper. A pre-requisite for any moth to extend its range is the ready availability of its larval foodplant. It is interesting that many of these invading species are those whose larval foodplants are conifers, widely planted either as a result of commercial forestry or as garden ornamentals, those which feed on planted non-native trees such as sycamore or plane, and those which are polyphagous and can utilize a wide range of non-native planted shrubs and herbaceous plants.

The way in which the moths treated have expanded into, and spread within the county has varied between species and these different patterns of spread are also considered. Not surprisingly many of these invading moths have entered Yorkshire from the south-east, from where their initial occurrence and establishment in Britain from continental Europe is both easiest and most likely. I will deal firstly with those moths that show this pattern, the majority of species in fact have taken this route.



MAP 1.

Yorkshire records of *Lozotaeniodes formosanus* (Geyer); ○ = 10 km. squares from where records were made in 1992, the first year it was reported in the county; and ● = subsequent records (see text).

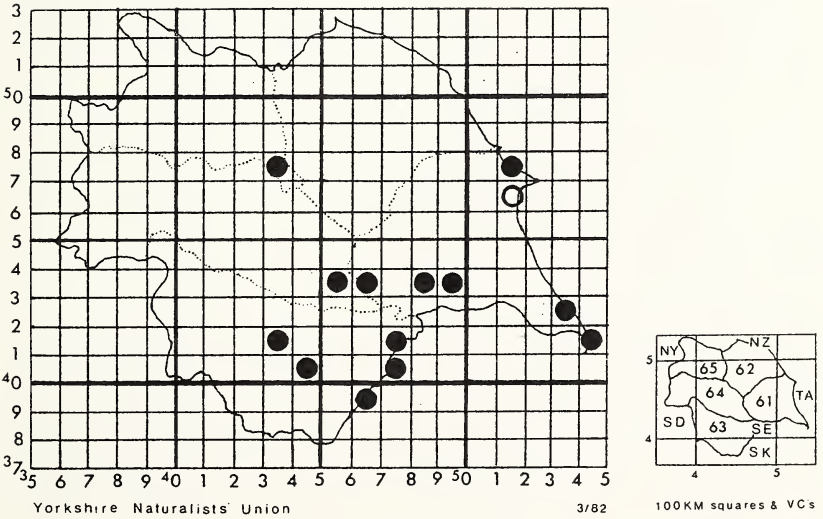
Lozotaeniodes formosanus (Geyer) [Map 1]

This distinctive pine-feeding tortricid moth was first recorded in Britain from Surrey in 1945. Its range expansion commenced almost immediately, over the following decade there were records from a number of localities in Kent, Hampshire (including the Isle of Wight), Middlesex, Essex, Dorset and Suffolk. From this south-eastern base it has spread steadily both northwards and westwards, reaching south Derbyshire in 1981 and north Wales in 1987. This relentless progress made it a likely future colonist of Yorkshire and indeed the first county records were made from four localities in VC61 (comprising four adjoining 10 km squares, SE73, SE83, SE93 & TA03) in July 1992. The following year saw its appearance at two localities in the south of VC63 in the Rotherham and Doncaster districts (SK69 & SE40), further moths at these localities in subsequent years confirming its resident status. Progress continued steadily with the moth reaching VC64 at Cawood

(SE53) in 1997 and Hutton Conyers, just into VC65 (SE37), by 2001, the latter locality probably representing the most northerly in Britain at the present time. In the south and south-east of Yorkshire it is now a regular feature of pine plantations and is often recorded at mercury vapour lights well away from its preferred habitat. There is, as yet, no record from VC62 although the moth may already occur there undetected. Although the initial expansion was undoubtedly in eastern England the moth has also continued to extend its range in the west, reaching south Lancashire in 1997.

Ptycholomoides aeriferanus (Herrich-Schäffer)
This tortricid moth, whose larvae feed on larch, was first recorded in Britain in Kent in 1951. Colonisation has been relatively slow, it was recorded sporadically over the following 20 years in Hampshire, Surrey, Sussex, Essex, Hertfordshire and northwards as far as Suffolk and Norfolk. The steady progress continued: 1982 saw it recorded from Staffordshire and the first Nottinghamshire occurrences were in 1991, although it was not recorded from the adjacent county of Derbyshire until 1994. The moth first made an appearance in Yorkshire in 1992 when a single moth occurred at Cottingham, near Hull (VC61); the following year it was found in woodland at Sheffield (VC63). There were further scattered records in both these vice-counties in subsequent years, the steady advance resulting in records from Silpho Forest (VC62) from 1996 onwards and at Hutton Conyers (VC65) in 2001. These are currently the most northerly British records but there can be little doubt that the range expansion will continue. The movement is also westerly as well as northerly, but as is usual with species spreading from the south-east, progress up the western side of England tends to lag behind that in the east, the first records from Cheshire and Lancashire being made in 1999.

Phlyctaenia perlucidalis (Hübner) [Map 2]
This pyralid moth shows a similar pattern of range expansion to those species already



Map 2.
Yorkshire records of *Phlyctaenia perlucidalis* (Hübner); ○ = site of the first county occurrence in 1983; and ● = subsequent records (see text).

mentioned which first colonised Britain in the south-east or East Anglia but it differs in that the larval foodplant is not a conifer or garden plant. The larvae feed on *Cirsium* species, apparently preferring cabbage-thistle. It was first recorded in Britain from Wood Walton Fen, Huntingdonshire in June 1951 but the specimens were not recognised until 1957 (Mere & Bradley, 1957). Subsequent British records were initially sparse and confined to the east coast and to fenland areas in East Anglia. However by 1980 it was being recorded quite regularly in eastern England from Kent to Lincolnshire and this increase in records heralded the first from Yorkshire, at Rudston, near Bridlington (TA16) in VC61 in July 1983, then by some way the most northerly British record. Its establishment continued to be slow, however, and it was not until 1987 that the moth was again seen in Yorkshire, at Rossington, near Doncaster (SK69) in VC63. In subsequent years there have been further records from VC63 in the Doncaster area, and from West Melton, near Rotherham (SE40) with a single record from Muston, near Filey (TA07) near the northern limit of VC61 in 1992. The slow spread continues: in addition to infilling its existing range with additional localities in VC61 and VC63, the moth was recorded in VC64 at Cawood (SE53) in 1995 and reached Hutton Conyers (SE37) in the south of VC65 during 2002. The latter locality is the most westerly in Yorkshire and together with the record from Muston also provides the most northerly in Britain to date.

Cacoecimorpha pronubana (Hübner)

This conspicuous day flying moth with its distinctive orange hindwings was first recorded in Britain from Sussex in 1905. Its spread has occurred more slowly than that of *Lozotaeniodes formosanus* but its distribution had extended into the midlands by the early 1970s (Bradley, 1973), it was recorded in Nottinghamshire in 1991 and from Derbyshire the following year. First recorded in Yorkshire from Bridlington (VC61) where a single moth was reported in 1997, it then occurred commonly in several localities in the south of VC63 around Rotherham and Sheffield and in VC62 at York in 1998. There have since been a number of widely scattered records from VC61 and particularly from VC63 where the more northerly localities include Baildon and Elland and with the first record from VC64 at Ilkley in 2001 and at Hutton Rudby, in the north of VC62 in 2002. Yorkshire is presently considered to be the northern limit of the natural expansion of this moth in Britain. There have been records from further north, an isolated occurrence in a garden in central Newcastle upon Tyne in 1981 (Dunn, 1989) and from Scotland, where moths occurred on spruce grown under polythene at a Forestry Commission Research Station in Midlothian in 1979 (Winter, 1982) and reared from willow shoots in a commercial nursery on Speyside in 1987. These records are all regarded as being the result of casual introductions. The larvae are polyphagous on a wide range of trees including conifers, various shrubs and herbaceous plants, over one hundred different foodplants having been recorded to date. It is very much a moth of suburban habitats, gardens, parks and allotments, seemingly preferring garden and cultivated plants and shrubs, and therefore a minor horticultural pest.

Pammene aurita Razowski

Although the first British specimens were taken at Dover, Kent in 1943 they remained unidentified until some years later (Bradley & Gardiner, 1958). From 1956 further moths were recorded in widely scattered localities in south-east England northwards to East Anglia, along the south coast in Hampshire and Devon and northwards to Gloucestershire and into Herefordshire and south Wales by 1975. The first Yorkshire record was of a single moth at Edlington Wood, near Doncaster (VC63) in early August 1991 after which there was no further county record until one was found dead in a water butt at Spurn (VC61) in July 1999. At this time there was no evidence that the species was established in Yorkshire, but a further record, this time of a live moth, was made at Spurn in the following year and in 2002 several were recorded. Meanwhile the moth had occurred quite commonly at mercury vapour light at Denaby Ings, near Mexborough (VC63) in mid-July 2000

(Beaumont, 2002) and also to the south east of Doncaster, at Rossington in 2001. It is evidently now resident in the southern extremities of vice-counties 61 and 63. A similar northward movement is taking place in western Britain, with the first records from Cheshire and south Lancashire being made in 2000. The larvae feed on the seeds of sycamore, so there is no reason why the moth should not further consolidate its position within the county where it is currently at the northern limit of its range in Britain. In the case of this moth the relatively slow northward progress may well be a consequence of its larval food preference; by the time sycamores are mature enough to produce seeds they are generally too large to be moved about in tree planting schemes and translocation of infected trees is unlikely to play a significant part in the range expansion of this species.

Argyresthia trifasciata Staudinger

This species is currently undergoing a rapid range expansion in northern Europe. The larval foodplants include juniper and Leyland cypress and there can be little doubt that the current disjunct distribution and rapid spread has been aided by transportation of infected foodplants by garden centres and the horticultural trade. As a consequence of its preferred foodplants most records are from urban areas or suburban gardens. The first British record, a single moth, was made at Hampstead, Middlesex in June 1982; a further 15 years elapsed before a second moth occurred, in Greater Manchester in 1997, followed by further examples from Hampshire and Surrey in 1998. During the following three years the species has spread rapidly from these areas, with records from Kent, Sussex, Essex, Hertfordshire, Norfolk and Northamptonshire in the south-east, while in the north-west there were further records from Cheshire and additionally from Lancashire. There was also a record from Aberdeen in Scotland in June 1999 (Palmer, 1999b). Whether the moth's first appearance in Yorkshire was as a result of spread from the southerly or the westerly populations or from an independent introduction with its foodplants can only be speculation, but the latter seems highly likely. The first specimens were recorded at Rossington, near Doncaster (VC63) in May 2000 where it has continued to be recorded in subsequent years, to be followed by its occurrence in 2001 at two further widely scattered sites, Holme-on-Spalding Moor (VC61) and York (VC62). Its appearance at such widely separated sites is strongly indicative of translocation of infected foodplants by the garden centre trade. Colonisation by this moth is still at an early stage and its future spread and population build-up will be watched with interest as it has the capacity to be a horticultural pest. Already in southern England larval numbers have reached sufficient density at some localities to cause severe browning of shoot tips of Leyland cypresses.

It may be worth mentioning at this point that *A. cuppressella* Walsingham, another *Argyresthia* species whose larvae feed on conifers, including Leyland cypress, was first recorded in Britain in 1997 (Agassiz & Tuck, 1999); an American species, it was discovered in Suffolk, the first record from Europe, where it was already so well established locally that its eradication was considered impossible and it has already begun to expand its range. Although presently still largely restricted to East Anglia, there have been records from Middlesex in 1998 and Berkshire in 2001. If the experience of *A. trifasciata* is repeated it may not be too long before this moth also reaches Yorkshire.

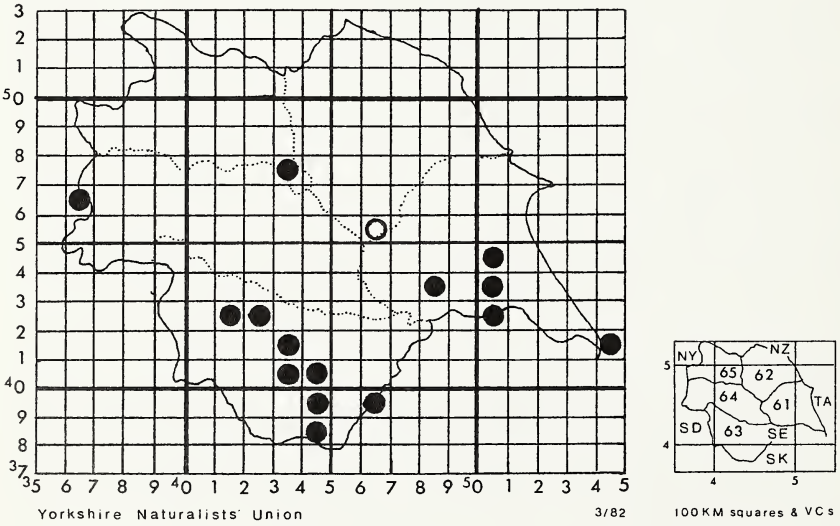
Phyllonorycter leucographella (Zeller)

This small moth, known as the Firethorn Leaf Miner, is a recently spreading inhabitant from southern Europe. It was first recorded in Britain from Essex in 1989 where it was already locally well established, its larvae mining the leaves of *Pyracantha*. It continued to expand its range steadily, being recorded widely in the south-east of England and into East Anglia by 1993. Subsequently a number of outlier populations were discovered; it was found to be established in south Derbyshire in 1990 (Beaumont, 1991) and was recorded from Nottingham shortly afterwards, but these populations beyond the advancing front were absorbed into the main area of distribution within a couple of years, so rapid was its progress. The nature of its foodplant, an ornamental shrub, makes translocation by the

garden centre trade and by landscaping schemes likely. How much relevance this had to its rapid spread remains debatable: at the initial Derbyshire site, larval mines appeared to be confined to a large and very mature shrub trained against a garden wall, but of course the moth may well have moved onto that particular shrub after being introduced to the area on smaller plants nearby. As early as March 1991 there was a record of tenanted larval mines on a potted *Pyracantha* in a garden centre at Epworth, Lincolnshire (R. I. Heppenstall, *pers. comm.*), not far from the Yorkshire boundary. The mass planting of *Pyracantha* in landscaping situations has obviously aided its establishment and spread; instances of its occurrence under such circumstances are of considerable populations on planted shrubs at Trowell motorway services area on the M1 in Derbyshire in July 1998 and adjoining the car parking area of a major supermarket at Askham Bar, York in April 1999. Its first appearance in Yorkshire was of a few larval mines on an established *Pyracantha* in Elmfield Park, Doncaster (VC63) in June 1996 from which moths emerged a few days later. By early 1998 the moth was also recorded from VC62 and VC64, larval mines often being described as abundant and by 2001 VC61 and VC65 had also provided records. The relentless push continues for I found mines on *Pyracantha* in a public park at Hexham, Northumberland in July 2002 and there has been a recent record from Scotland. There is a final twist in the tale of this successful and dynamic invader: during the past two years I have found the characteristic upperside larval mines on apple in my garden and it has been recorded elsewhere in Britain mining whitebeam (Palmer, 1999a) and hawthorn; its utilisation of native rosaceous trees and shrubs can only lead to a wider colonisation in rural habitats.

Epiphyas postvittana (Walker) [Map 3]

This moth presents an unusual case as it has expanded from a south-western base following accidental introduction. It is a moth with an interesting history: a native of Australia, it was reported intermittently in Britain during the early years of the 20th century among imported fruit (usually apples) originating from Australia; by the same means it had managed to



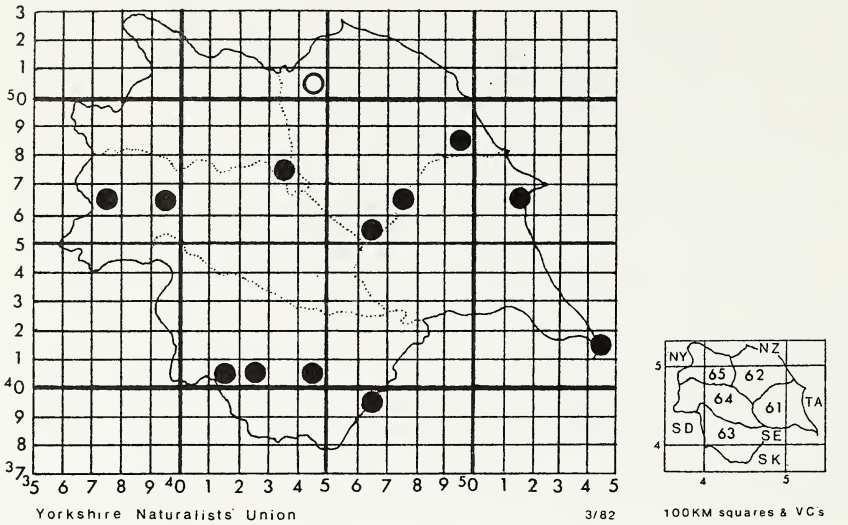
MAP 3.

Yorkshire records of *Epiphyas postvittana* (Walker); ○ = site of the first county record in 1991 and ● = subsequent records (see text).

establish itself in New Zealand, New Caledonia and Hawaii by the early 1900s. In 1933 it was found to be breeding in the Camborne area of Cornwall (Spalding, 1994) and established a bridgehead there although initially it made little, if any, progress in expanding its range. However, by 1973, some 40 years after its initial establishment, a slow expansion was evident. It had extended its distribution along the south coast of England into Devon and with a single record from Hampshire in 1967. From the 1980s came evidence of a more rapid extension of range: the moth reached Essex and the London area by 1983, after which its pattern of spread became more reminiscent of a species expanding from the south-east. A northerly spread into eastern England brought it to Leicestershire in 1990, Northamptonshire in 1993 and Derbyshire in 1994. This spread may also in part have been aided by transportation of early stages by the horticultural trade but there can be no doubt that there was a natural dynamic expansion of range at this time. It was first found in Yorkshire in VC62 when a single example from Haxby, near York (SE65) in late autumn 1991 was identified, a record which may have resulted from an accidental introduction. It then occurred at Cottingham, near Hull (TA03) in VC61 in 1992 after which it has been recorded annually and frequently there. Its spread to other parts of Yorkshire was initially slow but 1998 saw its arrival in the south of VC63 where it quickly increased in enormous numbers to become a commonly occurring moth. Records further north in VC63 followed, preceding the first VC64 record in 1999; interestingly this came from the far west of the vice-county, at Low Bentham (SD66). A northerly spread up the western side of the Pennines took place coincident with its spread in eastern England, with records from north Wales in 1983 and Lancashire in 1995. These Yorkshire records possibly represent the current natural northern limit of its range, although there have been instances of moths appearing at random well to the north, including one from Scotland in 2002. Its larvae are polyphagous, feeding on a wide range of shrubs and both wild and cultivated herbaceous plants. Ironically, although an economic pest of apples in Australia where it is variously known as the Light Brown Apple Moth or Apple Leaf Roller, there are few records of it feeding on apple in the wild in Britain although it has been reared on apple in captivity; in fact, most records of it feeding on apple here have been of it affecting the fruit rather than the foliage. Britain remains its sole outpost in the Palaearctic region for it has not been recorded elsewhere in adjacent European countries, its establishment in Britain undoubtedly owing much to our colonial past.

Caloptilia rufipennella (Hübner) [Map 4]

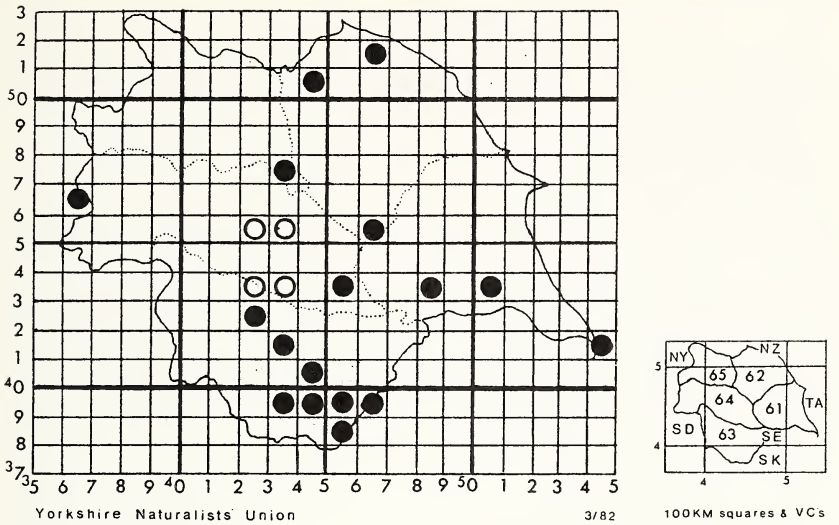
This is an example of a moth that appears to have become established along almost the entire eastern side of Britain, from whence it has spread quite rapidly westwards. Its first discovery in Britain at Chippenham Fen, Cambridgeshire in 1970 (Emmet, 1971) was followed by further records in Essex and East Anglia and it quickly proved to be widely and well established in that area. What was then presumed to be a discrete area of distribution was located in eastern Scotland in 1978 (Emmet, 1979) where the species was also subsequently found to be well established (Shaw, 1981). However, records in South Northumberland and Lincolnshire in 1980 and the first Yorkshire record, from the Cleveland Hills (NZ40) in VC62 in 1981 (Emmet, 1981), suggested that the gap between the two 'populations' was the result of under-recording. Further Yorkshire records came in 1984 from a Rothamsted Insect Survey trap operated at Wykeham Forest (SE98), and since 1989 the species has been recorded quite widely in VC61 and as far west as Austwick (SD76) in VC64. Since 1992, moths, or the characteristic larval cones on sycamore, have been found, sometimes commonly, at a number of localities in VC63 and there has been a single record from from Hutton Conyers (SE37) in VC65 in 2001. The westerly spread continues, with records from Cheshire and Lancashire in 1997 (Langmaid & Young, 1999).



MAP 4.
Yorkshire records of *Caloptilia rufipennella* (Hübner); ○ = site of the first county record in 1981 and ● = subsequent records (see text).

The following two species belong to the genus *Blastobasis*. Moths of this genus are largely subtropical in distribution, but two species have become established in Britain during the past 100 years, presumably by way of trade from Madeira where they are native. The larvae feed on a wide range of unrelated pabula which include seeds, dried fruit skins, in various galls, living and dead leaves and on a variety of detritus including dead insects and leaf litter, including that of yew which is especially favoured by larvae of *B. lignea*. The moths themselves are rather drab and undistinguished, which together with their larval habits led Meyrick (1928) to describe members of the genus as 'decidedly the least attractive of the micro-lepidoptera'. It is interesting that despite the two species having become established in, and recently spreading widely throughout Britain, except for a single record of *B. decolorella* from Sweden, neither has been recorded elsewhere in Europe.

Blastobasis lignea Wals. [Map 5]
This moth was first recorded in Britain in Lancashire in 1917, but subsequently an Irish specimen dating from 1902 was discovered. It then appeared in south-east England and expanded from these centres reaching Wales in the 1960s and Scotland during the 1970s. The moth was first recorded from Yorkshire when large numbers were identified in Rothamsted Insect Survey trap samples from Harrogate (SE35) in VC64 during the early 1970s (E. S. Bradford, *in litt.*) and where it was evidently already well established. From this centre it expanded into the Leeds area (SE23 & SE33) and to York (SE65) by 1985. It was not until 1995, however, that the moth began to be reported widely but from that year it has turned up, often in numbers, almost throughout the county from the south around Rotherham and Doncaster (VC63) where it now occurs commonly, in the far west at Low Bentham (SD66) in VC64 and north to Guisborough (NZ61) and Hutton Rudby (NZ40) in the north of VC62. In fact the past decade has seen a rapid range expansion extending throughout Britain and Ireland, which makes its complete absence from the rest of Europe



MAP 5.
Yorkshire records of *Blastobasis lignea* Walsingham; ○ = sites of the earliest county records in the early 1970s and ● = subsequent records (see text).

astonishing. How has it managed to reach Britain, seemingly becoming independently established in several localities, yet has not been recorded from Portugal which historically has greater trading and colonial links with Madeira?

Blastobasis decolorella (Woll.)
The first record in Britain was from London in 1946 from where it spread slowly at first but with increasing momentum from the 1980s. However, although the main thrust of its range extension was from the south-east it has appeared, seemingly at random, in widely separated areas. It was recorded, for example, in Glasgow in 1981 but not from Derbyshire until 1993. It was first recorded in Yorkshire in 1979 between Rotherham and Sheffield (VC63), and although there were further records from the same area this remained the only county site until 1985 when a moth was found at Whitby (VC62). A series of records followed from Cottingham (VC61) from 1991 onwards where it quickly increased in frequency. From the mid-1990s it has been recorded widely and quite commonly throughout VC63, although not occurring in the numbers of *B. lignea*, and from further widely scattered localities in VC61. In VC62 records are still confined to the east (possibly as a result of under-recording), and there are not, as yet, records from the westernmost areas of Yorkshire. There is still no record from VC64, but the moth was recorded from VC65, close to the VC64 boundary, during 2001. Although its distribution in Yorkshire remains patchy, this absence of westerly Yorkshire records is a little surprising as the moth was found to occur commonly in west Lancashire in 1995 and it has now been recorded widely throughout Britain to the northern extremities of the Scottish mainland.

To summarize the situation, the past 15 or so years have seen a considerable number of micro-lepidoptera species being recorded in Yorkshire for the first time in recorded history. Some of these instances consist of a single occurrence or of a few widely scattered

examples, making it difficult to know whether they are the forerunners of potential colonists or merely isolated wanderers. A substantial number are moths that are relatively recent arrivals into the British Isles and which have expanded their respective ranges, with varying degrees of rapidity, to become established in Yorkshire. Some other, rather longer established resident moths have also shown northerly range extensions of varying degrees during the same period.

The factors that have allowed these moths to extend their ranges substantially have operated principally during the past 15 years. It is interesting to note that those species that had gained a foothold to become resident in the British Isles in the early years of the twentieth century did not begin a wider range expansion significantly earlier than those that were first recorded in Britain during the 1950s or later. The fact that many of these rapidly invading species, have larvae that are conifer feeders or are polyphagous tends to rule out the lack of availability of suitable foodplants as being a factor previously limiting their range expansion. Many of these moths began to expand their distributions northwards at about the same time, which would seem to indicate that some common factor was involved; climatic influence seems the most probable, although this does not imply that such a factor operates identically on all the species involved.

For many moths the onset of warmer winter temperatures is more important than summer ones: the greatest obstacle faced by southern species spreading north has always been that of surviving northern winters. For many of them it is probably simply that the winters were formerly too cold, or the cold periods too extensive, to allow their over-wintering stage (be it egg, larva, pupa or adult depending on the species) to survive it. Some of the species originating well to the south of Britain are continuously brooded and have no diapause, i.e. they are unable to suspend their development at some stage to cope with the unfavourable conditions of the northern winters. Winters have become noticeably less severe during the past 15 or so years, with prolonged periods of lying snow and persistent frosts being relatively unusual; indeed the succession of winters throughout the 1990s have provided the mildest winter decade in recorded history. Increasingly warmer winters will benefit those moths whose larvae have no real diapause and continue to feed throughout the winter, albeit perhaps at a slower pace than summer feeding larvae, and thus are able to extend their range northwards. British winters, and certainly Yorkshire ones, are not yet mild enough to support a large range of such species consistently. Among those already mentioned, *Epiphyas postvittana* best fits this scenario: it is now well established through a succession of overlapping generations, resulting in all stages occurring simultaneously throughout the year in the milder south-west.

The key to success for some of these invading moths is their utilization of evergreen foodplants, for it is of no benefit to them if climatic amelioration allows their larvae to be able to survive winter temperatures if there is nothing for them to eat. This use of evergreen shrubs allows for larval feeding to continue during mild periods during the winter months, which may even allow an extra generation in favourable circumstances, thus aiding the rapidity of spread. Additionally, these cultivated plants are those that are often grown under glass, or in polytunnels, micro-habitats which can tip the balance of survival for moths at the extreme northern edge of their climatic tolerance.

The species treated in detail here are those that have already spread into, and become established in, Yorkshire. Already the continuing spread of additional species further south in Britain, and indeed in continental Europe, of moths that have not yet, but are considered likely to spread into Britain, indicates that further colonists can be expected in Yorkshire in the relatively near future. Among these are *Phyllonorycter platani* (Staudinger) larval mines of which were first found at South Kensington, London in 1990. The larvae of this moth, as suggested by its name, mine the leaves of plane trees; since its discovery in Britain it has been recorded westwards into Hampshire and Devon and northwards as far as Bedfordshire. The American moth *Argyresthia cupressella*, which has already been mentioned as spreading in southern England is another strong candidate, as are two further New World species associated with False Acacia, namely *Phyllonorycter robiniella*

(Clemens) and *Parectopa robiniella* Clemens, both of which are spreading northwards in continental Europe after having been introduced into southern Europe in the 1980s (Agassiz, 1996) although neither of these has yet reached Britain. The pine feeding pyralid moth *Dioryctria sylvestrella* (Ratzeburg) was first recorded in Britain from Kent as recently as 1999 (Parsons & Radford, 2002), although further examples from the same county dating back to 1995 were subsequently identified. It has already been recorded from West Sussex and Dorset and as far north as Cambridgeshire and Suffolk; in the latter county it was not uncommon during August 2002 and is evidently established there and so is a likely candidate to reach Yorkshire in the near future. Finally the spread across Europe of *Cameraria ochridella* (Deschka & Dimic), a leaf-mining moth affecting Horse Chestnut, is causing such concern that the Forestry Commission has recently issued an Exotic Pest Alert for this moth (Tilbury, 2002). First described in 1985 from Macedonia, the moth has spread rapidly northwards across Europe, reaching Austria in 1989, Germany in 1993 (Agassiz, 1996) and more recently Belgium, the Netherlands and France. In fact even this Presidential Address has been overtaken by events: since writing the above *Cameraria ochridella* has been discovered in Britain, at Wimbledon in July 2000 (D. Agassiz, *pers comm.*), and as its recent rate of advance across Europe has been c. 200 km. per annum, we should not have to wait more than two or three years for it to reach Yorkshire.

Acknowledgements

I wish to express my thanks to Dr David Agassiz (Gravesend) and Mr Peter Crowther (Kilnsea), who provided some of the slides which were used to illustrate this address and which supplemented my own meagre efforts, and to the members of the Yorkshire Naturalist's Union as a whole for according me the honour of being your President during the past year.

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TABLE 1
Summary of establishment in Britain and in Yorkshire vice-counties of species mentioned in the text.

Species	Year and place of first British record	Year of first Yorkshire VC records VC61	VC62	VC63	VC64	VC65
C. pronubana (Hübn.)	1905 Sussex	1997	1998	1998	2001	
B. lignea Wals.	1917 Lancashire	1994	1985	1995	1970	2001
E. postvittana (Walk.)	1933 Cornwall	1992	1991	1998	1999	2001
P. aurita Raz.	1943 Kent	1999		1991		
L. formosanus (Gey.)	1945 Surrey	1992		1993	1997	2001
B. decolorella (Woll.)	1946 London	1991	1985	1979		2001
P. perlucidalis (Hübn.)	1951 Huntingdonshire	1983		1987	1995	2002
P. aeriferanus (H.-S.)	1951 Kent	1992	1996	1993		2001
C. rufipennella (Hübn.)	1970 Cambridgeshire	1989	1981	1992	1989	2001
A. trifascisata Staud.	1982 Middlesex	2001	2001	2000		
P. leucographella (Zell.)	1989 Essex	2001	1998	1996	1998	2001

BOOK REVIEW

Seaweeds by **David Thomas.** Pp. 96, incl. numerous colour illustrations. Life Series, The Natural History Museum, London. 2002. £9.95 paperback.

This lavishly illustrated book provides a superb introduction to the study of these plants, once a major feature of British shorelines, but increasingly under pressure from tourism, marine pollution and coastal development. The once popular fieldwork undertaken by schoolchildren and students in sensitive rocky shore areas has to be discouraged these days, so books which can portray the diversity and ecological importance of these fundamental plants, such as the one under review, are therefore to be applauded.

MRDS

THE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF MESSINGHAM SAND QUARRY IN WATSONIAN LINCOLNSHIRE WITH SPECIAL REFERENCE TO RESIDENT AND TOURIST SPECIES

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Messingham Sand Quarry has been found to be a very good site for aculeate wasps and bees, having 117 recorded species, and eight species of national importance. The quarry is a nature reserve of The Lincolnshire Trust for Nature Conservation. It is situated just to the south of Scunthorpe (VC 54, SE9003) in the North Lincolnshire Coversands and Clay Vale Natural Area. With an area of 40.5 ha., the nature reserve is covered by post-glacial sand and consists of a series of lagoons (created by the excavation of sand), heathland remnants, acidic grassland, marsh and coniferous and deciduous woodland.

The nesting areas of the aculeate species are in the open sunny areas. Subterranean nesters are associated with bare ground or ground with thin short vegetation, often on slopes. Aerial nesters use dead wood and plant stems such as bramble. Trees and shrubs, e.g. sallow, hawthorn, gorse, broom, heather and bramble, and herbs, e.g. vetches and bird's foot trefoil, provide important food sources.

Methods

Between 1988 and 2001, the author made 28 visits distributed throughout the year as follows: April (3 visits), May (6), June (6), July (6), August (6) and September (1). The first 14 visits were made between 1988 and 1996, the next five visits during 1999, a further five visits during 2000, and four visits during 2001. During these approximately three hour visits all species of aculeate wasps and bees were recorded and usually collected with a hand net for identification. One additional record of a female *Nomada ruficornis* recorded on 14 May 1994 was supplied by A. Godfrey. In the following account the nomenclature can be related to Kloet & Hincks (1978). An up-to-date checklist can be found on the Bees, Wasps and Ants Recording Society (BWARS) web pages at http://www.bwars.com/.

Species present and the seasonal progression of species

A full list of recorded species is given in the Appendix. At the family and subfamily level Table 1 shows the taxonomic distribution of species and records. A record represents a specimen differing in one of the following three variables: name, sex and day of visit. There are slightly more solitary wasp species than solitary bee species but distinctly more solitary wasp records than solitary bee records (ratio of wasp 1.33:1.00 bees). Of the solitary wasp families, the Sphecidae is the dominant family both in terms of the number of species and the number of records, although the Pompilidae are well represented. Of the solitary bee subfamilies the Andreninae and Halictinae are the dominant subfamilies, although the Anthophorinae are well represented.

Table 2 shows the numbers of species recorded and when species were first recorded for each month. The most productive months for solitary wasp species were June, July and August with June the most productive month for the first recording of species. June, July and August are the summer months so most wasp species would seem to have to wait until the warmer summer months before the adults can become active. The subterranean nesting spider-hunting wasps (Pompilidae) are particularly noticeable as they fly very quickly just above the surface of the sandy soil in open situations. *Episyron rufipes* and *Pompilus cinereus* nest in aggregations around which swarm numerous males. *Evagetes crassicornis* is a cleptoparasitic pompilid wasp on other subterranean nesting pompilids. The female cleptoparasite enters the cell of its host, eats the host's egg and substitutes her own. Its main hosts are probably *Arachnospila anceps* and *Anoplius nigerrimus*. The commonest

TABLE 1
Number of species and records from Messingham Sand Quarry

	Species	Records
Solitary wasps		
Chrysididae	4	7
Mutillidae	1	2
Pompilidae	14	84
Eumeninae	3	8
Sphecidae	32	165
Total solitary wasps	54	266
Solitary bees		
Colletinae	4	20
Andreninae	14	61
Halictinae	19	78
Megachilinae	2	6
Anthophorinae	8	35
Total solitary bees	47	200
Total solitary species	101	466
Social wasps and bees		
Vespinae	5	
Apinae	11	
Total solitary wasps and bees	16	
Total wasps and bees	117	

sphecid species are the fly hunters *Crabro cribrarius*, *Ectemnius continuus*, *Crossocerus quadrimaculatus* and *Oxybelus uniglumis*; the caterpillar hunter *Ammophila sabulosa*; the beetle hunter *Entomognathus brevis*; and the small aphid hunter *Diodontus tristis*. All these sphecid species are subterranean nesters except for *E. continuus* which nests in decaying wood. *Oxybelus uniglumis* also nests in aggregations and carries its captured prey on its extended sting.

The most productive months for solitary bee species were May, June, July and August with April, May and June the most productive months for the first recording of species. The

TABLE 2
Number of solitary species and months when species were first recorded at Messingham Sand Quarry

	Apr	May	Jun	Jul	Aug	Sep
Number of species						
Wasps	0	5	37	37	31	9
Bees	14	25	20	17	17	4
Number of species first recorded						
Wasps	0	5	34	10	5	0
Bees	14	17	11	4	1	0

commonest species include the spring species *Andrena haemorrhoa* and *A. scotica*, the summer species *Colletes succinctus* and *A. denticulata* which are particularly dependent on heather as a pollen source, and *Andrena bicolor* which has a spring and summer generation. Fertilized females of *Halictus rubicundus*, *Lasioglossum leucozonium* and *L. villosulum* emerge in the spring and rear a summer generation of females and males. *Specodes monilicornis*, which is the cleptoparasite of *H. rubicundus*, was also particularly noticeable. All of above solitary bee species are subterranean nesters.

The mean of species of solitary wasps and bees found per visit for each month was: April (5.7 species, range 5-7 species), May (10.8, range 5-14), June (17.0, range 13-23), July (17.8, range 12- 21), August (15.7, range 11-20), September (1 visit, 14 species).

Estimating the potential number of solitary wasp and bee species

One of the problems in the study of any site is the difficulty of not knowing how many more species are present at the site, but as yet unrecorded. Recent advances in non-parametric statistical procedures offer a way of addressing this problem. Chao (in Colwell & Coddington, 1994) and Heltshe and Forrester (1983) describe procedures to estimate the potential number of species (species richness) likely to be found on a site after a number of samples have been taken. The presence/absence quantitative estimate of Chao is based on the number of species that are recorded in one (unique species) or two (two-occasion species) samples. The Jackknife estimate of Heltshe and Forrester is based on the unique species. Because some aculeate species are only active in the spring or summer it is advisable that samples be distributed throughout the months of adult activity. The software to carry out these statistical procedures was provided by Pisces Conservation Ltd.

The statistical procedures were run after 14, 19, 24 and 28 samples (or visits) had been made. In practice the software takes 1, 2, etc. samples at random, each time calculating a mean estimate of species richness. The procedure is continuously repeated dependent on the number of samples. With a small number of samples the estimates are erratic, but as more samples are selected these may stabilise, giving confidence in them. The estimates of species richness with their 95% confidence limits are given in Table 3. The estimates of species richness based upon Chao procedure after 14 and 28 visits are given in Figs 1 and 2. The estimates stabilise after 28 visits with an estimated species richness of about 127 species of which 101 species (about 80%) have been recorded.

Previous experience using non-parametric statistical procedures to determine estimates of species richness from sites in Watsonian Yorkshire and Lincolnshire produced stabilised estimates after 12 (Gibraltar Point, Archer 1998, 2000) to 18 (Gundale, Archer 2001) visits. As such, the number of visits (28) to Messingham Sand Quarry is much larger. Why should this be so?

Recorded species at any site could be resident, tourist or vagrant species. Resident species obtain all their resources, mainly nesting sites and food, from the site under study while tourist species, although living in the geographical area of the site, do not normally obtain their resources from the site. Vagrant species, normally occurring away from the geographical area of the site, were not found at Messingham Sand Quarry.

It is often difficult to separate resident and tourist species. Probably tourist species will tend to be unique species, or found on few occasions, as only small numbers would be expected to be present on the site and hence unlikely to be found. Unfortunately unique species could also be rare resident species, which again have small numbers on site and are hence unlikely to be found.

Table 4 shows the number of visits on which each species was recorded. There are 28 unique species, which represents more than a quarter (27.7%) of all the recorded species. Clearly there are many species that could be rare resident or tourist species. It is therefore necessary to generate more specific arguments to begin to separate the rare resident and tourist species. Three arguments can be forwarded to separate out, at least, some of the tourist species: 1. Parasitic species whose host(s) is (are) not present on the site – *Chrysis angustula*, *Trichrysis cyanea*, *Nomada striata*, *N. panzeri*. 2. Species which are not

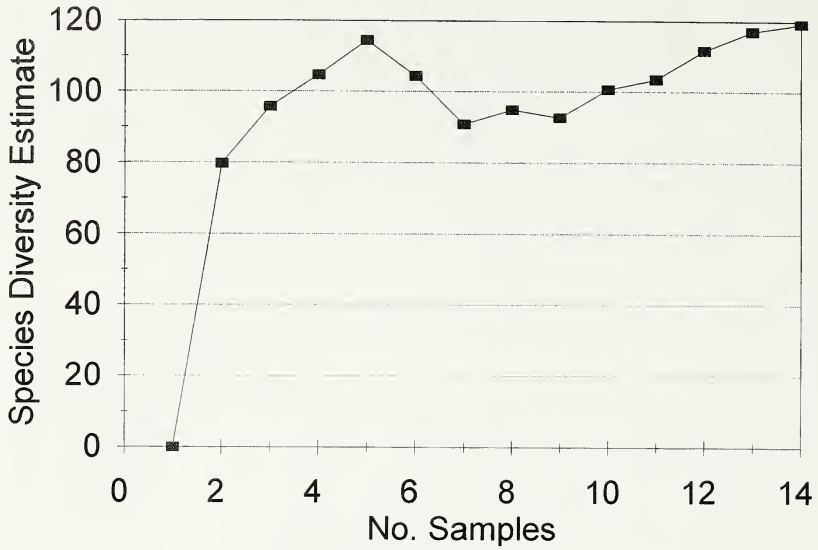

FIGURE 1.
The Chao presence/absence estimate of species richness for all records after 14 visits to Messingham Sand Quarry.

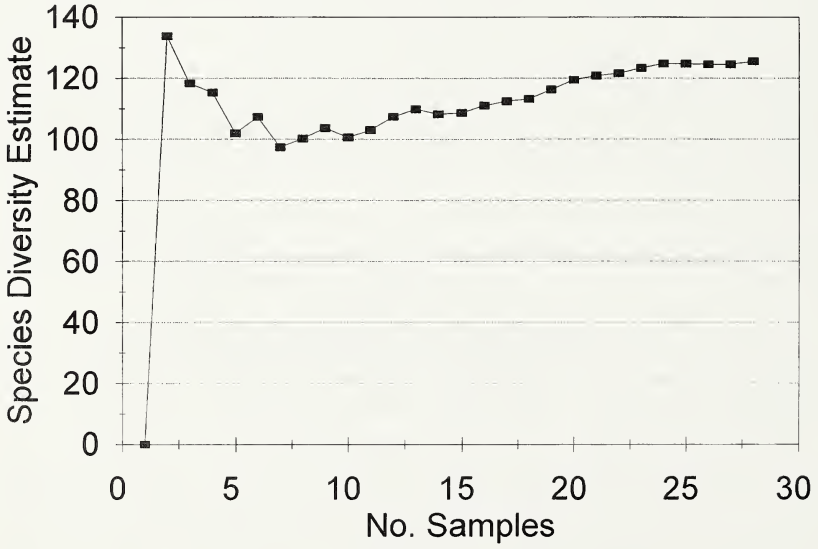

FIGURE 2.
The Chao presence/absence estimate of species richness for all records after 28 visits to Messingham Sand Quarry.

TABLE 3
Non-parametric estimates of species richness at Messingham Sand Quarry with the tourist species after 14, 19, 24 and 28 visits

	Chao estimate	Jackknife estimate
After 14 visits		
No. species recorded	78	78
No. species estimated	119	110
95% confidence limits	87-151	95-125
% of estimated species found	66	71
After 19 visits		
No. specis recrorded	90	90
No. species estimated	126	122
95% confidence limites	98-154	108-136
% of estimated species found	71	74
After 24 visits		
No. species recorded	98	98
No. species estimated	137	130
95% confidence limits	107-167	119-141
% of estimated species found	72	75
After 28 visits		
No. species recorded	101	101
No. species estimated	126	128
95% confidence limits	105-146	115-140
% of estimated species found	80	79

associated with the habitats present on the site because they lack the necessary resources – *Ectemnius sexcinctus*, *Philanthus triangulum*, *Andrena lapponica*, *A. wilkella*, *Halictus tumulorum*. *E. sexcinctus* and *P. triangulum* are two species which have recently undergone a national expansion in range and would have been expected to be found on several visits if their required resources were present on the site. 3. Species that are locally common and would have been expected to be found on several visits if they were resident species – *Priocnemis schioedtei*, *Andrena subopaca*, *A. chrysosceles*. These twelve tourist species were all unique species except for *Chrysis angustula*, *Andrena chrysosceles*, *Halictus tumulorum* and *Nomada panzeri* which was recorded on two visits.

With the twelve tourist species removed a stable estimate of species richness is obtained after 19 visits (Table 5, Fig. 3). This smaller number of visits corresponds with earlier

TABLE 4
Number of visits on which each species of solitary wasp and bee was found

No. visits	No. species	No. visits	No. species
1	28	9	3
2	16	10	1
3	11	11	1
4	6	12	1
5	14	13	0
6	7	14	1
7	7	15	1
8	4		

experience and indicates that Messingham Sand Quarry has about 100 resident solitary wasp and bee species of which 80 species (about 80%) have been recorded.

Two further problems now arise. Firstly, why are tourist species present on the site? Have the tourist species flown onto the site by accident or are there functional reasons for

TABLE 5

Non-parametric estimates of species richness at Messingham Sand Quarry without the tourist species after 14, 19, 24 and 28 visits

	Chao estimate	Jackknife estimate
After 14 visits		
No. species recorded	71	71
No. species estimated	97	96
95% confidence limits	74-120	84-108
% of estimated species found	73	74
After 19 visits		
No. specis recrorded	80	80
No. species estimated	98	103
95% confidence limites	81-115	92-114
% of estimated species found	82	78
After 24 visits		
No. species recorded	86	86
No. species estimated	108	108
95% confidence limits	88-128	100-116
% of estimated species found	80	80
After 28 visits		
No. species recorded	89	89
No. species estimated	106	108
95% confidence limits	89-122	100-117
% of estimated species found	84	82

their presence? Although it not possible to rule out completely their accidental presence it is possible that many tourist species are in dispersal phase, looking for new habitat for range expansion. As examples, from among the suggested tourist species, *Philanthus triangulum* requires as a nesting site a large sloping, bare sandy areas facing south. Such sandy areas are absent at Messingham Sand Quarry. There are also tourist parasites present which would be unable to find their hosts. Furthermore, *Halictus tumulorum* is usually associated with calcareous open sites while Messingham Sand Quarry is a sandy site.

The second problem relates to the observation that even with the tourist species removed, after the 24th and 28th samples, the species richness estimates, although still stable, have increased to about 108 species. It might be expected that once a stabilised estimate had been obtained, after the 19th sample the estimate would continue to have a similar value for a few years. Certainly the estimates after the 24th and 28th samples are similar, so that perhaps stopping after the 19th sample was premature. The advice would then be that a few more samples should be taken even after the estimates have stabilised.

Alternatively, it is possible that because of management changes at Messingham Sand Quarry some rare resident species have increased their population sizes and so become more visible to the recorder. Certainly management was actively creating new habitats during the period of this study. These management changes could also have allowed new immigrant species to find the resources they need to complete their life-histories on site.

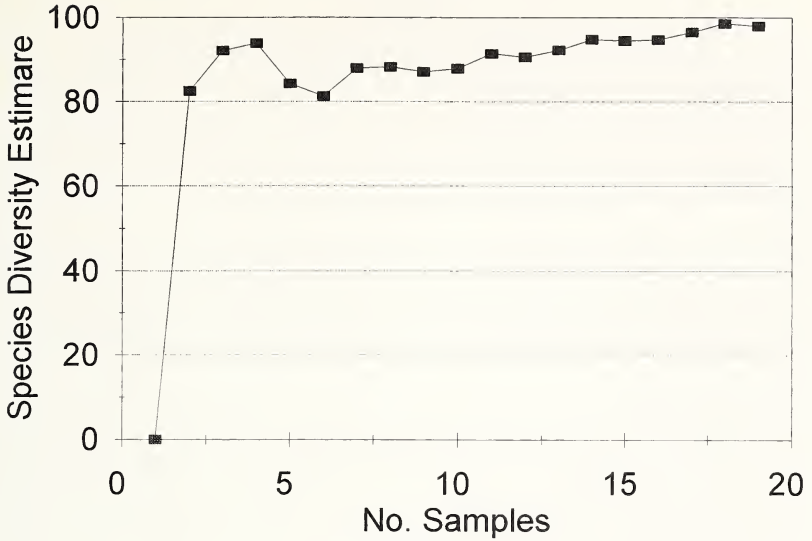

FIGURE 3.
The Chao presence/absence estimate of species richness for all records, less the tourist species, after 19 visits.

SPECIES-AREA RELATIONSHIP

Another problem in the study of any site, particularly when the estimate of the number of species is greater than the number recorded, is the difficulty of knowing when the recorded species list is sufficiently complete to enable reasonable comparisons with other sites to be carried out. One way to resolve this question is to make use of the species-area relationship (Usher, 1986), where the number of recorded solitary species and the area of each site, both expressed as natural logarithm (ln), are plotted against each other. Archer (1999) found that for north Midland and northern English sites the resulting correlation coefficient was statistically highly significant, indicating a positive linear relationship. Thus, if the number of species in relation to the area of the site falls within the range of these sites, then the site may reasonably be compared with other sites. The data for Messingham Sand Quarry fall within this range (95% confidence limits of the regression coefficient) so can be compared with other sites from the north Midlands and northern England.

QUALITY ASSESSMENT OF THE SOLITARY SPECIES

According to Shirt (1987), *Andrena tibialis* and *Sphecodes reticulatus* are nationally rare or 'Red Data Species' (RDB3). Falk (1991) suggested these two species be downgraded to nationally scarce status (Na). In addition, according to Falk (1991), *Cleptes semiauratus*, *Arachnospila minutula* and *Sphecodes crassus* should be given nationally scarce status (Nb). Recent work by the Bees, Wasps and Ants Recording Society would indicate that a further three species should be given a national scarce status (Archer 1999, 2002): *Anoplius concinnus*, *A. viaticus* and *Diodontus tristis*. These eight species are all at or near the northern edge of their national distribution.

By giving each of the 101 species of solitary wasps and bees an Archer national status (Archer 1999, 2002), a national quality score of 187 (Table 6) can be calculated for Messingham Sand Quarry and a national species quality score (SQS) of 1.9 (187/101).

TABLE 6
The Archer national quality scores of the solitary species recorded at Messingham Sand Quarry

National Status	Status value (A)	No. species (B)	Quality scores (A x B)
Universal	1	63	63
Widespread	2	30	60
Restricted	4	0	0
Scarce	8	8	64
Total		101	187

National SQSs for other Lincolnshire sites have similar values: Gibraltar Point (1.7), Kirkby Moor (1.9), Risby Warren (1.8) and Saltfleetby-Theddlesthorpe dunes (1.8).

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasitic rates are higher in temperate regions as host populations are more synchronised in their life-history characteristics, except hot deserts where the occurrence of rainfall would tend to synchronise life-history characteristics. From a review of the literature Wcislo (1987) found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%. As such, CLs for sites in Britain should have similar values. For the north Midlands and north England, the CLs for species of solitary bees varies from 21.7%-36.6% (range 14.9%) (Archer 1999). The CL for Messingham Sand Quarry (Table 7) falls within this range and therefore supports the Wcislo's hypothesis.

Wcislo (1987) gives no CLs for wasps, but Archer (1999) found that CLs of solitary wasps for sites from north Midlands and north England varied from 10.3%-22.2%. The CL for Messingham Sand Quarry (Table 7) falls within this range.

Aerial Nester Frequency

The aerial-nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters use old beetle burrows in dead wood, central plant stem cavities (e.g. bramble), old snail shells, or crevices in old mortar or exposed on the surface of rock or other hard material. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered.

The AFs for the solitary wasp and bee species are given in Table 8. The AFs for all the British species of solitary wasps is 46.2% and solitary bees is 17.9%. Thus the AFs for Messingham Sand Quarry are lower than the national values, probably indicating the lack of dead wood in sunny situations.

TABLE 7
The relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species recorded from Messingham Sand Quarry

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic load CL = 100 x C/(H+C)
Solitary wasps	7*	46	13.2%
Solitary bees	16	31	34.0%

**Cleptes semiauratus* not included

TABLE 8
The nesting habits of the solitary species from Messingham Sand Quarry

	No. aerial nesters (A)	No. suberranean nesters (S)	Aerial nester frequency AF = 100 x A/(A+S)
Solitary wasps	13	33	28.3%
Solitary bees	3	28	9.7%

Summary

Messingham Sand Quarry:

1) is a very good site for aculeate wasps and bees with 117 recorded species and eight species of national importance;
2) is predicted to have a species diversity of 126-128 species, of which probably about 20 are tourist species;
3) has the expected number of solitary species for its area, and so can be properly be compared with other sites;
4) has a species quality score expected for the best Lincolnshire sites;
5) has solitary wasp and bee cleptoparasitic loads similar to those from other sites as predicted by Wcislo (1987); and
6) has a low aerial nester frequency compared with British data indicating relatively fewer aerial nesters compared with subterranean nesters.

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APPENDIX

Chrysididae. *Cleptes semiauratus* (L.), *Hedychridium ardens* (Latreille *in* Coquerbert), *Chrysis angustula* Schenck, *Trichrysis cyanea* (L.).

Mutillidae. *Myrmosa atra* Panzer.

Pompilidae. *Priocnemis exaltata* (Fab.), *P. parvula* Dahlbom, *P. perturbator* (Harris), *P. schioedtei* Haupt, *Pompilus cinereus* (Fab.), *Arachnospila anceps* (Wesmael), *A. minutula* (Dahlbom), *A. trivialis* (Dahlbom), *Evagetes crassicornis* (Shuckard), *Anoplius concinnus* (Dahlbom), *A. infuscatus* (Vander Linden), *A. nigerrimus* (Scopoli), *A. viaticus* (L.), *Episyron rufipes* (L.).

Eumeninae. *Ancistrocerus parietinus* (L.), *A. trifasciatus* (Müller), *Symmorphus bifasciatus* (Panzer).

Vespinae. *Dolichovespula media* (Retzius), *D. sylvestris* (Scopoli), *Paravespula germanica* (Fab.), *P. vulgaris* (L.), *Vespula rufa* (L.).

Sphecidae. *Dryudella pinguis* (Dahlbom), *Tachysphex pompiliformis* (Panzer), *Trypoxylon attenuatum* Smith, *T. figulus* (L.), *Crabro cribrarius* (L.), *C. peltarius* (Schreber), *Crossocerus ovalis* Lepeletier & Brullé, *C. pusillus* Lepeletier & Brullé, *C. tarsatus* (Shuckard), *C. wesmaeli* (Vander Linden), *C. annulipes* (Lepeletier & Brullé), *C. quadrimaculatus* (Fab.), *Ectemnius continuus* (Fab.), *E. sexcinctus* (Fab.), *Lindenius albilabris* (Fab.), *Entomognathus brevis* (Vander Linden), *Rhopalum coarctatum* (Scopoli), *Oxybelus uniglumis* (L.), *Mimesa equestris* (Fab.), *M. lutaria* (Fab.), *Pemphredon inornata* Say, *P. lethifera* (Shuckard), *Diodontus luperus* Shuckard, *D. tristis* (Vander Linden), *Passaloecus gracilis* (Curtis), *Ammophila sabulosa* (L.), *Mellinus arvensis* (L.), *Nysson spinosus* (Forster), *N.trimaculatus* (Rossius), *Gorytes quadrifasciatus* (Fab.), *Argogorytes mystaceus* (L.), *Philanthus triangulum* (Fab.).

Colletinae. *Hylaeus communis* Nylander, *Colletes daviesanus* Smith, *C. fodiens* (Geoffroy *in* Fourcroy), *C. succinctus* (L.).

Andreninae. *Andrena clarkella* (Kirby), *A. fucata* Smith, *A. lapponica* Zetterstedt, *A. praecox* (Scopoli), *A. scotica* Perkins, *A. bicolor* Fab., *A. nigroaenea* (Kirby), *A. denticulata* (Kirby), *A. haemorrhoa* (Fab.), *A. tibialis* (Kirby), *A. barbilabris* (Kirby), *A. chrysosceles* (Kirby), *A. subopaca* Nylander, *A. wilkella* (Kirby).

Halictinae. *Halictus rubicundus* (Christ), *H. tumulorum* (L.), *Lasioglossum latriventre* (Schenck), *L. leucozonium* (Schranck), *L. albipes* (Fab.), *L. calceatum* (Scopoli), *L. nitidiusculum* (Kirby), *L. punctatissimum* (Schenck), *L. rufitarse* (Zetterstedt), *L. villosulum* (Kirby), *L. leucopus* (Kirby), *Sphecodes crassus* Thomson, *S. ephippius* (L.), *S. geoffrellus* (Kirby), *S. gibbus* (L.), *S. monilicornis* (Kirby), *S. pellucidus* Smith, *S. puncticeps* Thomson, *S. reticulatus* Thomson.

Megachilinae. *Megachile versicolor* Smith, *M. willughbiella* (Kirby).

Anthophorinae. *Nomada fabriciana* (L.), *N. goodeniana* (Kirby), *N. leucophthalma* (Kirby), *N. marshamella* (Kirby), *N. panzeri* Lepeletier, *N. ruficornis* (L.), *N. striata* Fab., *Epeolus variegatus* (L.).

Apinae. *Bombus lucorum* (L.), *B. terrestris* (L.), *B. lapidarius* (L.), *B. jonellus* (Kirby), *B. pratorum* (L.), *B. hortorum* (L.), *B. pascuorum* (Scopoli), *B. bohemicus* (Seidl), *B. sylvestris* (Lepeletier), *B. vestalis* (Geoffroy *in Fourcroy), Apis mellifera* L.

THE ALEOCHARINAE (COLEOPTERA: STAPHYLINIDAE) OF YORKSHIRE

M. L. DENTON

With over 100 years of Aleocharinae recording in the county, there is a wealth of distributional data available on the YNU database. The Aleocharinae have always been a taxonomically difficult group and during the first half of the 20th century it was not widely appreciated that genitalic dissection was paramount for correct identifications. Joy (1932), although illustrating the male genitalia of *Philhygra* (as *Atheta)*, only gives external characteristics for the identification of all the remaining Aleocharinae. It is only within the last 50 years that dissection of the genitalia (both male and female) has been recognised as the only way upon which specific identifications can be correctly accomplished for certain species. As a consequence, some early 20th century records are suspect, and are discussed in more detail in the following species accounts.

In the late 1940s through to the 1970s, E. W. Aubrook was particularly interested in the group, and he was probably one of the first Yorkshire coleopterists to appreciate dissection as a means of identification. A large proportion of his collection is now housed at the Manchester University Museum. In the early 1980s through to the present time a wealth of recording was undertaken by R. J. Marsh, E. J. Smith and the author. Several coleopterists not specialising in the group, notably L. Auckland, W. A. Ely and W. R. Dolling, have made specimens available for inspection, and visits by specialists not resident in the county e.g. C. Johnson and R. C. Welch, have also added considerably to our knowledge of distribution. This wealth of distributional data, along with any known ecological information, is brought together in the species accounts which follow. It must be remembered, however, that coverage of the county has not been even and, although four of Yorkshire's five vice-counties (61-64) have been well worked, the other, VC65, has suffered from a lack of recording. This can be attributed to its remoteness, and the fact that no specialist has resided in the area.

In the list which follows, full details of the record are given if the species has been recorded in the county on six or fewer occasions. For other species, unless widely distributed, a breakdown of the number of localities within each vice-county is indicated. As this method gives no indication as to when the species was last recorded, details of the last record are given.

For the purposes of evaluating invertebrate faunas and priorities for conservation action, invertebrates are attributed various rarity status categories, the meanings of which are given below. Criteria for the selection of species into the three Red Data Book categories follow Shirt (1987), with minor modifications derived from Hyman and Parsons (1994), as follows:

1) RED DATA BOOK CATEGORY 1. RDB1 – ENDANGERED. Species which are known or believed to occur as only a single population within one 10 km square of the National Grid.
2) RED DATA BOOK CATEGORY 2. RDB2 – VULNERABLE. Species which are declining throughout their range.
3) RED DATA BOOK CATEGORY 3. RDB3 – RARE. Species which are estimated to exist in only 15 or fewer 10 km squares; this criterion may be relaxed where populations are likely to exist in over 15 squares but occupy small areas of an especially vulnerable habitat.
4) RED DATA BOOK CATEGORY I. RDB I – INDETERMINATE. Taxa considered to be Endangered, Vulnerable or Rare, but where there is not enough information to say which of the three categories (RDB1 to 3) is appropriate.
5) DATA BOOK CATEGORY K. RDBK – INSUFFICIENTLY KNOWN. Taxa recently discovered or recognised in Great Britain, which may prove to be more widespread in the future (although some recent discoveries may be placed in other categories if the

group to which they belong is thought not to be under- recorded).
6) PROVISIONAL RED DATA BOOK. pRDB. The prefix 'p' before any Red Data Book category implies that the grading is provisional.
7) NOTABLE A. Species which are thought to occur in 30 or fewer 10 km squares or, for less well-recorded groups, within seven or fewer vice-counties.
8) NOTABLE B. Species which are thought to occur in 31 to 100 10 km squares or, for less well recorded groups, between eight and twenty vice-counties.
9) NOTABLE. Species which are estimated to occur within the range of 16 to 100 10 km squares; subdivision of this category into Notable A and Notable B has not been attempted.
10) INDETERMINATE. Species considered to be Endangered, Vulnerable or Rare, but there is insufficient information to say which of these categories is appropriate.
11) INSUFFICIENTLY KNOWN. Taxa with very few known localities, but which belong to a poorly recorded or taxonomically difficult group.
12) LOCAL. The term is not rigidly defined, but loosely means species confined to a particular habitat type (usually associated with better quality examples of that habitat), a particular geographic area, or species that are too widespread to warrant Nationally Scarce (Notable) status but are nevertheless infrequently encountered.
13) COMMON. Common or very widespread species, frequently recorded.
14) UNKNOWN. Species where no status has been attributed. There may be confusion over the species' taxonomy, it may belong to a poorly recorded group or may occur in an infrequently sampled habitat.

The initials of the following people appear in species accounts:
RBA = R.B. Angus, JS = J. Ashworth, EWA = E.W. Aubrook, LA = L. Auckland, JHB = J.H. Bailey, RGB = R.G. Booth, HB = H. Britten, ROSC = R.O.S. Clarke, HHC = H.H. Corbett, MLD = M.L. Denton, WRD = W.R. Dolling, WAE = W.A. Ely, JHF = J.H. Flint, WDF = W.D. Fordham, WJF = W.J. Fordham, RLF = R.L. Fowler, AG = A. Godfrey, EJG = E.J. Green, CWH = unknown initials, MH = M. Hammond, DGH = D.G. Hemingway, WDH = W.D. Hincks, PJH = P.J. Hodge, ECH = E.C. Horrell, RJH = R.J. Hunt, JBJ = J.B. Jobe, CJ = C. Johnson, PK = P. Kendall, FEK = F.E. Kenington, RSK = R.S. Key, KL = K. Lawson, RL = R. Lawson, DAL = D.A. Lott, RGL = R.G. Loxton, RJM = R.J. Marsh, DM = D. Maude, RM = R. Merritt, EWM = E.W. Merse, SLM = S.L. Mosley, JM = J. Muona, EN = English Nature, EAN = E.A. Newbury, JAO = J.A. Owen, KGP = K.G. Payne, WES = W.E. Sharp, GS = G. Simpson, PS = P. Skidmore, AS = A. Smith, EJS = E.J. Smith, TS = T. Stainforth, WOS = W.O. Steel, CES = C.E. Stott, CET = C.E. Tottenham, YU = York University, GBW = G.B. Walsh, EAW = E.A. Waterhouse, RCW = R.C. Welch, TW = T. Wilkinson and SAW = S.A. Williams.
The sequence and nomenclature follows Lott and Duff (2002).

Gymnusa brevicollis (Paykull). Local. Generally found in moss in marshy places. Widely distributed in the county with records from all VCs with the exception of VC65. Last record: Strensall Common (VC64) in 2002; MLD.
Gymnusa variegata Kiesenwetter. Notable. Confined to marshy places. Recorded from 13 widely scattered Yorkshire localities: VC61 (2), VC62 (3), VC63 (6) and VC65 (2). Last record: Knowl Top Ponds, Meltham (VC63) in 2001; MLD.
Deinopsis erosa (Stephens). Local. Found in damp places, mainly in woodland. Recorded from seven Yorkshire localities: VC61 (4), VC63 (1) and VC64 (2). Last record: Lambwith Stream (VC61) in 1999; WRD (teste MLD).
Myllaena brevicornis (Matthews). Common. Widely distributed and common in the county with records from all VCs but, rather surprisingly, there are no records from the eastern half of VC61. Last record: Rabbit Ings (VC63) in 2002; MLD.
Myllaena dubia (Gravenhorst). Common. A very fast moving species which is found in moss and plant litter. Widely distributed in Yorkshire with records from all VCs. Most

records, however, stem from VC61 and 63. Last record: Marfield Fen, Masham (VC65) in 2002; RJM.

Myllaena elongata (Matthews). Notable. Found in damp places where it has been located with *Bledius* (Staphylinidae) and *Heterocerus* (Heteroceridae). There are six Yorkshire records: (VC61) Haverfield Quarry in 1999; WRD det. MLD. Patrington Haven in 2000; WRD (teste MLD). (VC62) Scarborough on an unrecorded date; RL. Sandsend in 1935; HB. Leven Bridge in 1944; MLT. (VC63) Bretton Park in 1948; EWA.

Myllaena graeca Kraatz. Doubtfully native. The only British record concerns two specimens taken on the coast at Scarborough (VC62) in the late 19th century; TW. This species has a Mediterranean distribution and it is doubtful that its occurrence in the British Isles is anything more than "adventitious" (*Ent. Monthly Mag.* **104**: 183-187).

Myllaena gracilis (Matthews). Unknown. Widely distributed in England, but chiefly southern. Found in wet places. There are four Yorkshire records: (VC61) Thornton Ellers in 1989; RJM (teste CJ). Fisherman's Channel in 1991; RJM. (VC64) Hagg Wood in 1963; EWA. Askham Bog in 1999; DAL.

Myllaena infuscata Kraatz. Unknown. Widely distributed in Yorkshire (only one record from VC65) with most records stemming from the eastern half of the county. Last record: Marfield Quarry, Masham (VC65) in 2002; RJM.

Myllaena intermedia Erichson. Common. Found in wet places. Despite the national status of 'Common' the species has only been recorded from six Yorkshire localities: (VC61) Skipwith Common in 1971; EWA. Wheldrake Ings in 1989; RJM (teste CJ). (VC62) Burniston on an unrecorded date; recorder unknown. (VC63) Sprotbrough Flash in 1971 and 1972; both EWA. Conisbrough in 1992; RJM. (VC64) Studley in 1989; CJ.

Myllaena kraatzi Sharp. Notable. Found in bogs and marshes. There are seven Yorkshire records: VC61 (1), VC62 (3), VC63 (1) and VC65 (2). Last record: Potteric Carr (YWT reserve) (VC63) in 2002; RJM.

Myllaena minuta (Gravenhorst). Common. A very fast moving species which is found in moss and leaf litter. Despite the national status of 'Common' the species has only been recorded from 11 Yorkshire localities: VC61 (3), VC63 (2), VC64 (4) and VC65 (2). Last record: Marfield Quarry, Masham (VC65) in 2002; RJM.

Oxypoda acuminata (Stephens) (= ***lividipennis*** Mannerheim). Common. Widely distributed in the county with a small number of records from all VCs. Last record: Dale Dyke (VC63) in 1998; EJS.

Oxypoda alternans (Gravenhorst). Common. Generally found in decaying fungi. Widely distributed and common in the county with records from all VCs (only one from VC65). Last record: Upper Stone Wood, Shepley (VC63) in 2002; MLD.

Oxypoda annularis Mannerheim. Unknown. Widely distributed in Yorkshire with records from all VCs with the exception of VC65. Last record: Sandall Beat Wood (VC63) in 2002; WRD det. MLD.

Oxypoda brachyptera (Stephens). Local. Recorded from nine widely scattered Yorkshire localities: VC61 (5), VC63 (2), VC64 (1) and VC65 (1). Last record: Manor farm, Eddlethorpe (VC61) in 2000/2001; RGL det. MLD.

Oxypoda brevicornis (Stephens) (= ***umbrata*** (Gyllenhal)). Local. Widely distributed and common in the county with records from all VCs (only one from VC65). Last record: Wath Manvers (VC63) in 2002; MLD.

Oxypoda carbonaria (Heer) (= ***sericea*** Heer). Unknown. Recorded from 20 Yorkshire localities: VC61 (2), VC62 (5), VC63 (12) and VC64 (1). Last record: Whiteley Wood (VC63) in 2000; EJS (teste MLD).

Oxypoda elongatula Aube. Common. Widely distributed and common in Yorkshire with records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Oxypoda exoleta Erichson. Notable. Generally found in sandy and heathy habitats. Past confusion with other members of the genus renders the records from Lockwood (VC63) in 1948 (EWA) and Spurn (VC61) in 1950, 1951 and 1952 (all WOS) unreliable without voucher specimens. The only authentic Yorkshire records are from: (VC61) Sunk Island in

1986; MLD & RJM (both teste CJ). Aughton Ings in 1988; RJM. (VC62) Rawcliffe Meadows in 1997; MLD det. CJ. (VC63) Sprotbrough in 1990; RJM det. CJ.

Oxypoda flavicornis Kraatz (= ***amoena*** Fairmaire & Laboulbene). Notable. Found throughout England and also south-east Scotland. There are six Yorkshire records: (VC61) Spurn in 1950; WOS. Kilnsea in 1950; WOS. (VC63) Hade Edge in 1985; DM det. MLD (teste CJ). Langsett in 1986; EJS. Rocker Rocks in 1997; EJS (teste MLD). (VC64) Askham Bog in 1997; RGB.

Oxypoda formiceticola Maerkel. Unknown. This ants' nest associate has been recorded from ten Yorkshire localities: VC62 (6) and VC63 (4). Last record: Upper Derwent Valley (VC63) in 1989; EJS.

Oxypoda haemorrhoa (Mannerheim). Unknown. Widely distributed and common in Yorkshire with records from all VCs. Last record: Sandall Beat Wood (VC63) in 2002; RJM.

Oxypoda induta Mulsant & Rey. Unknown. There are three county records: (VC62) Whitby in 1935; HB. Skelder (not Skeldon as stated in *Naturalist* **125**: 74) in 1935; HB. (VC63) Whiteley Wood in 1998; EJS (teste MLD).

Oxypoda islandica Kraatz. Notable. Confined to moorland and mountains in northern England. There are two county records, both from VC64: Malham Tarn in 1955; WOS. Penyghent in 1967; CJ.

Oxypoda lentula Erichson. Common. Despite the national status of 'Common' the species has only been recorded from eight Yorkshire localities: VC61 (4), VC62 (1) and VC63 (3). The VC61 localities are all in the Lower Derwent Valley. Last record: Pot Ridings Wood (VC63) in 2002; MLD.

Oxypoda longipes Mulsant & Rey. Unknown. There are three Yorkshire records: (VC61) Bubwith in 1916; WDF and 1918; WJF. (VC63) Mag Wood in 1983; DM det. MLD (teste CJ).

Oxypoda nigricornis Motschulsky. Notable. This montane species has been recorded from the Midlands, northern England and north-east Scotland. There are four Yorkshire records: (VC63) Brun Moor in 1985; DM det. MLD (teste CJ). Drop Clough in 1987; DM det. MLD. Cartledge Flat in 1988; EJS. (VC64) Malham Tarn in 1967; CJ.

Oxypoda opaca (Gravenhorst). Common. Widely distributed and common in the county with records from all VCs (only one from VC65). Last record: Sharow Mires, Ripon (VC65) in 2002; RJM.

Oxypoda procerula Mannerheim. Local. Found in litter and moss in wet places. Widely distributed in Yorkshire with records from all VCs; only one from VC65 but, more surprisingly, none from the eastern half of VC61. Last record: Rabbit Ings (VC63) in 2002; MLD.

Oxypoda spectabilis Maerkel. Notable. Found throughout the British Isles in a wide variety of habitats. There are Yorkshire records from nine localities: VC62 (5), VC63 (2) and VC64 (2). Last record: Crowden Great Brook (VC63) in 1985; DM det. MLD (teste CJ).

Ocyusa maura (Erichson). Local. A species of marshy places. Recorded from 15 Yorkshire localities (mainly in the southern half of the county): VC61 (3), VC63 (9) and VC64 (3). Last record: Potteric Carr (YWT reserve) (VC63) in 2002; RJM.

Cousya nitidiventris (Fagel). pRDBK. This is a little known species which has been recorded from six widely scattered vice counties, all in England (Yorkshire being the most northerly). There is a single county record: Ringinglow (VC63) in 1964; ROSC det. SAW. This specimen added the species to the Britain list (*Proc. Br. Ent. Nat. Hist. Soc.* **12**: 46-48).

Deubelia picina (Aube). Unknown. Recorded from six Yorkshire localities: (VC61) Wheldrake Ings in 1991; MLD (teste CJ). (VC62) Duncombe Park in 1987; RJM (teste CJ). (VC63) Rivelin in 1998; EJS det. MLD. Botany Bay, Wintersett in 1999 and 2000; MLD. Rabbit Ings in 2002; MLD. (VC64) Collingham in 1917; CWH det. WES.

Chilomorpha longitarsis (Thomson) (= ***Ocyusa hibernica*** (Rye)). Notable. Restricted to north Wales, northern England and northern Scotland where it is found at the tops of

mountains and on high moorland. The Yorkshire records are all from localities on the North York Moors (VC62): Danby Low Moor in 1987; YU det. MLD (teste CJ). Kildale Moor in 1987; YU det. RJM. Spaunton Moor in 1987; YU det. MLD. Levisham Moor in 1987; YU det. MLD. Danby High Moor in 1987 and 1988; YU det. MLD.

Calodera aethiops (Gravenhorst). Common. Widely distributed in the county with records from all VCs (only one from VC65). Last record: Wheldrake Ings (VC61) in 1999; MLD.

Calodera nigrita Mannerheim. Notable. Confined to England where it is found in wetlands and marshy habitats. There are six Yorkshire records: (VC61) Thorganby in 1971; EWA. (VC62) Scarborough on an unrecorded date; recorder unknown. Rawcliffe Meadows in 1997; MLD (teste CJ). (VC63) Thorne Moor in 1985; EJS (teste CJ). (VC64) Bishop Wood in 1983; RJM (teste CJ). (VC65) Marfield Quarry, Masham in 2002; RJM.

Calodera protensa Mannerheim. RDB I. A species of wet habitats which has only been recorded from Essex, Oxfordshire and Yorkshire. The two Yorkshire records are both from Cawood (VC64): during 1990; KGP det. CJ and 1992; KGP det. MLD. These records are the first since the 1920s, when the species was recorded from Yarnton, Oxfordshire.

Calodera riparia Erichson. Notable. Associated with wet habitats. Recorded from eight Yorkshire localities: VC61 (2), VC62 (1), VC63 (4) and VC64 (1). Last record: Grange Park (VC63) in 1999; RM det. MLD.

Parocyusa* (= *Chiloporata*) *longitarsis (Erichson). Common. Lives on mud at the side of water, especially rivers. Widely distributed in Yorkshire with numerous records from all VCs. Last record: Marfield Fen, Masham (VC65) in 2002; RJM.

Parocyusa* (= *Chiloporata*) *rubicunda (Erichson). Notable. Generally found on the banks of rivers and streams. There are three Yorkshire records: (VC62) Scarborough on an unrecorded date; RL. Duncombe Park in 1983; RJM. (VC65) Raydale Beck, Semerwater in 1985; RSK det. MLD.

Ischnoglossa prolixa (Gravenhorst). Unknown. Found under bark. The realisation that two species were masquerading under this name (*Ent. Record* **106**: 241-244) has cast doubt on all previous records. Examination of extant, and more recently taken specimens, has revealed records from 11 Yorkshire localities: VC61 (1) and VC63 (10). Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Thiasophila angulata (Erichson). Unknown. There are records from 13 Yorkshire localities: VC62 (7) and VC63 (6). Last record: Barns Cliff (VC62) in 1995; LA det. MLD.

Crataraea suturalis (Mannerheim). Unknown. There are Yorkshire records from eight localities: VC61 (1), VC62 (1), VC63 (3), VC64 (2) and VC65 (1). Last record: Marfield Fen, Masham (VC65) in 2002; RJM.

Haploglossa gentilis (Maerkel). Local. This species has been found in owls' nests and also the nests of the ant *Lasius fuliginosus*. There is a single Yorkshire record: Spurn (VC61) in 1950; WOS.

Haploglossa nidicola (Fairmaire). Unknown. Associated with the nests of Sand Martin *Riparia riparia*. There are Yorkshire records from eight widely scattered localities: VC61 (3), VC62 (1), VC63 (2), VC64 (1) and VC65 (1). Last record: Blaxton Common (VC63) in 2000; RJM (teste MLD).

Haploglossa villosula (Stephens) (= ***pulla*** (Gyllenhal)). Common. Found in passerine birds' nests, and also found on flowers. Recorded from ten Yorkshire localities: VC62 (6), VC63 (1), VC64 (2) and VC65 (1). Last record: Honley Wood (VC63) in 1984; MLD.

Mniusa incrassata (Mulsant & Rey). Local. Widely distributed in the county with numerous records from all VCs. Rather surprising, however, is the lack of records from the eastern half of VC61. Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Ocalea badia Erichson. Unknown. There are five Yorkshire records: (VC62) Scarborough on an unrecorded date; CES. Forge Valley in 1926; recorder unknown. Raincliffe Wood in 1986; MLD det. CJ. (VC63) Upper Windleden Reservoir in 1985; DM det. MLD (teste CJ). (VC64) Tadcaster in 1969; EWA.

Ocalea latipennis Sharp. Local. Found in sand and shingle on the banks of rivers. Due to past confusion with *O. rivularis* Miller, the following records are suspect: (VC62)

Scarborough on an unrecorded date (WCH). Raincliffe Wood on an unrecorded date (GBW). (VC64) Bingley in 1908 (recorder unknown). The only authentic record is from Langsett (VC63) in 1985; DM det. MLD (teste CJ).

Ocalea picata (Stephens). Common. Widely distributed and common in the county with numerous records from all VCs (but not recorded from the eastern half of VC61). Last record: Broomhead Wood (VC63) in 2000; EJS.

Ilyobates nigricollis (Paykull). pRDBK. Restricted to very few counties, Yorkshire being the most northerly. The records from Scarborough (VC62) on an unrecorded date and Roundhay Park (VC64) in 1910 are probably referable to *I. bennetti* Donisthorpe. The only authentic county records are from Askham Bog (VC64) in 1965; EWA & CJ and Langsett (VC63) in 1990; EJS det. CJ.

Ilyobates propinquus (Aube). Notable. Predominantly southern in distribution, Yorkshire being on the species' northern limit. There are two county records: (VC61) Manor Farm, Eddlethorpe in 2000/2001; RGL det. MLD. (VC63) Rossington Bridge in 1985; RJM.

Ilyobates bennetti Donisthorpe (= ***subopacus*** Palm). Notable. Restricted to England (although past confusion with *I. nigricollis* (Paykull) clouds the known distribution). There are six Yorkshire records from four localities: (VC61) Wheldrake Ings in 1979; CJ. Bubwith Bridge in 1985; PK det. RJM, 1986; PK det. MLD and 1993; MLD. (VC63) Shirley Pool in 1986; RJM (teste CJ). (VC64) Hopewell Farm in 2000; MLD.

Amarochara umbrosa (Erichson). Notable. This is a subterranean species which is associated with small mammal runs. There are two county records, both from VC62: Saltburn in 1896; MLT. Netherby Dale in 1988; WAE det. CJ.

Phloeopora corticalis (Gravenhorst). Notable. Restricted to England where it is associated with woodland, wood-edge and scrub. Recorded from ten Yorkshire localities: VC61 (1), VC62 (2), VC63 (6) and VC64 (1). Last record: Booth Wood, Wortley (VC63) in 1997; EJS (teste CJ).

Phloeopora testacea (Mannerheim). Common. Found under bark. Widely distributed in Yorkshire (especially in the southern half of the county) with records from 26 localities: VC61 (1), VC62 (7), VC63 (15) and VC64 (3). Last record: Haw Park (VC63) in 2003; MLD.

Dinarda dentata (Gravenhorst). Notable. Associated with the nests of ants (certain *Formica* sp.). Past confusion with the commoner *D. maerkeli* Kiesenwetter clouds the national distribution. There is a single Yorkshire record: Hellwath Beck (VC62) in 1937; HB.

Dinarda maerkeli Kiesenwetter. Unknown. With the exception of a single VC63 locality (in SD93) the other Yorkshire localities (8) are all in VC62. Last record: Scar Wood (VC62) in 1988; DAL.

Meotica apicalis Benick. Unknown. Widely distributed in Yorkshire with records from 12 localities: VC61 (3), VC62 (1), VC63 (7) and VC64 (1). Last record: Rossington (VC63) in 1985; RJM (teste CJ).

Meotica exilis (Gravenhorst). Unknown. There are four Yorkshire records: (VC61) Spurn in 1949; WOS. Thorganby in 1971; EWA. (VC64) Askham Bog in 1996; RGB and JAO. (VC65) Hall Garth Ponds, Ripon in 2002; RJM.

Meotica exillima Sharp. Local. Found in moss in damp places. Despite the national status of 'Local' there are only two county records, both from VC63: Agden (not the YWT reserve) in 1987; EJS. Rushy Moor in 1987; RJM (teste CJ).

Ischnopoda (= ***Tachyusa***) ***atra*** (Gravenhorst). Local. Mainly found on sandy riverbanks. Widely distributed in Yorkshire with records from all VCs (only one from VC65). Last record: Blackmoorfoot Reservoir (VC63) in 2001; MLD.

Ischnopoda (= ***Tachyusa***) ***coarctata*** Erichson. Notable. Found in reed beds and river and lake margins in southern Britain (north to Yorkshire). There is a single county record: (VC63) Green Wood (formerly Kaye Wood) in 1948; EWA det. HB.

Ischnopoda (= ***Tachyusa***) ***constricta*** Erichson. Unknown. The 14 Yorkshire records are all from the northern half of the county: VC61 (1), VC62 (9), VC64 (3) and VC65 (1). Last

record: River Rye, Helmsley (VC62) in 2000; DGH det. MLD.

Ischnopoda* (= *Tachyusa*) *leucopus (Marsham). Local. Found on wet silt, sand and shingle beside clean moving water. Widely, but thinly, distributed in the county but not recorded from VC65 or, more surprisingly, the eastern half of VC61. Last record: River Rye, Helmsley (VC62) in 2000; MLD and RJM.

Ischnopoda* (= *Tachyusa*) *umbratica Erichson. Unknown. There are two Yorkshire records, both from VC62: Redcar in 1913; WJF. Ravenscar on an unrecorded date; recorder unknown.

Gnypeta caerulea (Sahlberg). Notable. Confined to the margins of rivers. With the exception of an undated record from VC62 (in TA09), the other Yorkshire records (from seven localities) are all from the eastern half of VC64 and 65. Last record: Aysgarth (VC65) in 1991; RJM.

Gnypeta carbonaria (Mannerheim). Local. Found on the muddy banks of rivers and ponds. Even when excluding the early 20th century records (which may have included *G. rubrior* Tottenham), the species is widely distributed in the county with records from 40 localities: VC61 (6), VC62 (10), VC63 (19) and VC64 (5). Last record: Rabbit Ings (VC63) in 2002; MLD.

Gnypeta ripicola (Kiesenwetter). Notable. Confined to habitats near water, particularly the banks of rivers, streams and ponds. The species has only been recorded in southern Britain (north to Yorkshire), but it may be more widely distributed than currently thought as it was not recognised as British until 1980 (*Ent. Monthly Mag.* **116**: 37-39). There are three Yorkshire records: (VC62) Duncombe Park in 1993; RJM (teste CJ). (VC63) Margery Wood in 1989; EJS (teste CJ). Damflask in 1995; EJS (teste MLD).

Gnypeta rubrior Tottenham. Local. Found on the muddy banks of rivers. There are six county records: (VC61) Spurn in 1949; WOS. Rudston in 1989; RBA det. CJ. Beacon Ponds in 2001; WRD det. MLD. (VC62) Robin Hood's Bay in 1935; HB. (VC63) Blackmoorfoot Reservoir in 1984; MLD det. CJ. Langsett in 1987; EJS (teste CJ).

Dasygnypeta* (= *Gnypeta*) *velata (Erichson). Notable. Associated with watery habitats and confined to southern Britain, Yorkshire being at the species' northern limit. There are two county records, both from Wheldrake Ings (VC61) during 1992; both MLD det. CJ.

Dacrila fallax (Kraatz). Notable. A wetland species which is confined mainly to southern Britain, Yorkshire being at the species' northern limit. There are four county records, all from VC61: Spurn in 1948; WOS. Haverfield Quarry in 1991; MLD (teste CJ). Fisherman's Channel in 1991; RJM. Broomfleet in 1993; RJM.

Callicerus obscurus Gravenhorst. Unknown. Widely, but thinly, distributed in Yorkshire with records from 12 localities: VC61 (3), VC62 (2), VC63 (4) and VC64 (3). Last record: Manor Farm, Eddlethorpe (VC61) in 2000/2001; RGL det. MLD.

Callicerus rigidicornis (Erichson). Unknown. Widely distributed in VC63 (9 localities), the only others are in VC61 (1), VC64 (2) and VC65 (1). Last record: Nostell Priory (VC63) in 2003; MLD.

Schistoglossa curtipennis (Sharp). Unknown. As undissected specimens or females of this species may include *S. benicki* Lohse, the records from Yedingham (VC62) in 1931 (GBW) and Langsett (VC63) in 1989 (EJS) are removed from the Yorkshire list. Authentic records of males are all from VC63: Deer Hill in 1983; MLD. Yateholme in 1985; DM det. MLD. Hades in 1985; DM det. MLD. Rushy Moor in 1986; RJM (teste CJ). Ewden Pond in 1997; EJS det. MLD. Blackmoorfoot Reservoir in 1998; MLD.

Schistoglossa gemina (Erichson). Notable. Generally associated with wetlands. There are six county records: (VC62) Bubwith Bridge in 1987; RJM. North Duffield Ings in 1987; RJM. (VC63) Rushy Moor in 1985; RJM (teste CJ). Rossington Bridge in 1987; RJM (teste CJ). (VC64) Askham Bog in 1971; EWA. Bishop Monkton Ings in 1997; MLD.

Boreophilia eremita (Rye). Local. Widely distributed with records from all VCs but, rather surprisingly, there are none from the eastern half of VC61. Last record: Deer Hill (VC63) in 2000; MLD.

Hydrosmecta delicatula (Sharp). pRDBK. Associated with fine shingle besides rivers and

streams. There is a single Yorkshire record: Scarborough (VC62) on an unrecorded early 20th century date; RL.

Hydrosmecta eximia (Sharp). Local. There are two county records, both from VC62: Scarborough on an unrecorded date; RL. Whitby on a mid-20th century date; HB.

Hydrosmecta fragilis (Kraatz). Notable. Found in the fine sandy shingle besides rivers and streams. There are two Yorkshire records, both from VC62: Saltburn in 1901; MLT. Scarborough on an unrecorded date; RL.

Aloconota cambrica (Wollaston). Unknown. There are four county records: (VC62) Hilla Green in 1925; GBW. Whitby in 1935; HB. Mulgrave Wood in 1935; HB. (VC64) Queen Mary's Dub in 1948; EWA.

Aloconota currax (Kraatz). Unknown. Widely, but thinly, distributed in the county with records from all VCs (only one from both VC64 and 65). Last record: River Rye, Helmsley (VC62) in 2000; DGH det. MLD.

Aloconota gregaria (Erichson). Common. Widely distributed and common in the county with records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Aloconota insecta (Thomson). Common. Despite the national status of 'Common' the species has only been recorded from 17 widely scattered Yorkshire localities (spanning all VCs). Last record: Blackmoorfoot Reservoir (VC63) in 2001; MLD.

Aloconota sulcifrons (Stephens). Unknown. Widely, but thinly, distributed in Yorkshire with records from all VCs (only one from VC62, 64 and 65). Last record: Woodhouse Mill Ponds, Huddersfield (VC63) in 2000; MLD.

Aloconota languida (Erichson). Notable. Past confusion with other members of the genus renders the records from Bubwith (VC61) in 1915 (GBW), 1918 and 1919 (both WJF) unreliable without voucher specimens. The only authentic record is from Sharow Mires (VC65) in 2002; RJM (teste MLD).

Pycnota paradoxa (Mulsant & Rey). Notable. Confined to England where it is normally associated with moles' nests. There are four county records: (VC61) Bubwith in 1914 and 1916; WJF. North Duffield Carrs in 1916; WJF. (VC64) Roundhay in 1910; EWM.

Amischa analis (Gravenhorst). Common. Widely distributed and common in the county, with numerous records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Amischa bifoveolata (Mannerheim) (= ***cavifrons***) (Sharp)). Local. Widely distributed in Yorkshire with records from all VCs. Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Amischa decipiens (Sharp). Local. Widely distributed, especially in the east and south of the county, with records from all VCs. Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Amischa forcipata Mulsant & Rey. Unknown. Found in moss, plant debris, etc. Recorded from seven Yorkshire localities: VC61 (2), VC63 (4) and VC64 (1). Last record: Nicholson's Lagoons, Ripon (VC64) in 2002; RJM.

Amischa nigrofusca (Stephens) (= ***soror*** (Kraatz)). Unknown. National distribution clouded as the species was previously considered a variety of *A. analis* (Gravenhorst). Recorded from 12 Yorkshire localities: VC61 (3), VC63 (7), VC64 (1) and VC65 (1). Last record: River Cover, Middleham (VC65) in 1995; JBJ (teste MLD).

Amidobia talpa (Heer). Notable. A woodland species that is associated with ants. With the exception of a record from VC61 (in TA21), the other county records are from VC62 (8 localities) and VC63 (4). Last record: Barns Cliff (VC62) in 1995; LA det. MLD.

Nehemitropia lividipennis (Mannerheim) (= ***sordida*** (Marsham)). Common. Widely distributed and common in Yorkshire with records from all VCs with the exception of VC65. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Notothecta confusa (Maerkel). Notable. Generally associated with ants. There is a single county record: Hall Dike (VC63) in 1983; DM det. MLD (teste CJ).

Notothecta flavipes (Gravenhorst). Unknown. The 14 Yorkshire records are from localities in VC62 (7) and VC63 (7). Last record: Barns Cliff (VC62) in 1995; LA det. MLD.

Lyprocorrhe anceps (Erichson). Unknown. Recorded from nine Yorkshire localities: VC62 (6), VC63 (2) and VC64 (1). Last record: Barns Cliff (VC62) in 1995; LA det. MLD.

Alaobia* (= *Atheta*) *gagatina (Baudi). Local. Found in fungi. Widely, but thinly, distributed in the county with records from all VCs (mainly VC63). Last record: Wykeham Forest (VC62) in 2001; LA det. MLD.

Alaobia* (= *Atheta*) *pallidicornis (Thomson). Local. Recorded from 24 Yorkshire localities: VC61 (1), VC62 (5), VC63 (12) and VC64 (6). Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Alaobia* (= *Atheta*) *sodalis (Erichson). Unknown. Widely distributed in Yorkshire with records from all VCs (only one from VC61). Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Alaobia* (= *Atheta*) *taxiceroides Munster. Local. Despite the national status of 'Local' there are only five county records: (VC62) Woodhouse Plantation in 1995; LA (teste MLD). (VC63) New House Wood in 1998; MLD (teste CJ). Toftwood in 1998; EJS (teste MLD). Molly Carr Wood in 1999; MLD. T.P. Wood, Marsh in 2001; MLD.

Alaobia* (= *Atheta*) *trinotata (Kraatz). Common. Widely distributed and common in Yorkshire, with records from all VCs (only one from VC65). Last record: New Park Spring, Grimethorpe (VC63) in 2002; MLD.

Brundinia* (= *Atheta*) *marina (Mulsant & Rey). Unknown. All Yorkshire localities for this species are clustered around the mouth of the River Humber (VC61) with records between Spurn and Fisherman's Channel, Sunk Island. Last record: Welwick Salt Marsh (YWT reserve) in 1998; WRD det. MLD.

Brundinia meridionalis (Mulsant & Rey). Unknown. The four Yorkshire localities are all in the lower reaches of the Humber Estuary (VC61): Spurn in 1952; WOS. Sunk Island in 1986; RJM (teste CJ). Beacon Ponds in 1990; MLD. Fisherman's Channel in 1991; MLD and RJM.

Dochmonota clancula (Erichson). Notable. A wetland species which is confined to England. There are Yorkshire records from eight localities: VC61 (2), VC63 (3) and VC64 (3). Last record: Potteric Carr (YWT reserve) (VC63) in 2002; RJM.

Ousipalia caesula (Erichson). Local. There is a single Yorkshire record: Givendale (VC62) in 1925; GBW det. HB.

Geostiba circellaris (Gravenhorst). Common. Widely distributed and common in the county, with numerous records from all VCs. Last record: Orange Wood, Blackmoorfoot (VC63) in 2003; MLD.

Dinaraea aequata (Erichson). Common. Widely distributed and common in the county with records from all VCs. Most records, however, stem from the southern half of the county. Last record: Sharow Mires, Ripon (VC65) in 2002; RJM.

Dinaraea angustula (Gyllenhal). Local. Widely distributed in the county, but not as common as *D. aequata* (Erichson), with records from all VCs (only one from VC65). Most records, however, are from the southern half of the county. Last record: Spurn (VC61) in 2001; MLD.

Dinaraea linearis (Gravenhorst). Unknown. There are three Yorkshire records: (VC62) Rawcliffe Meadows in 1997 (not 1996 as stated in *Naturalist* **125**: 73); MH det. MLD. (VC63) Shirley Pool in 1911; recorder unknown. Melton Wood in 1982; RJM (teste CJ).

Dadobia immersa (Erichson). Local. Generally found under bark in woodland (both deciduous and evergreen). Recorded from nine Yorkshire localities: VC61 (1), VC62 (2), VC63 (3) and VC64 (3). Last record: Brook Farm, Elstronwick (VC61) in 2002; WRD (teste MLD).

Plataraea brunnea (Fabricius). Local. Found in plant debris, etc. Widely distributed in Yorkshire, but not common, with records from all VCs (only one for VC65). Last record: New Park Spring, Grimethorpe (VC63) in 2002; MLD.

Liogluta alpestris ssp. ***nitidula*** (Kraatz). Local. Recorded from 21 Yorkshire localities: VC61 (2), VC62 (15), VC63 (3) and VC64 (1). The species is particularly numerous at a number of localities on the North York Moor (VC62). Last record: Trough House Moor

(VC62) in 1988; YU det. MLD.

Liogluta granigera (Kiesenwetter). Local. Restricted to Scotland and northern England. Recorded from 16 Yorkshire localities: VC61 (1), VC62 (4), VC63 (9) and VC64 (2). Last record: Turkey Carpet (VC62) in 1994; LA det. MLD.

Liogluta longiuscula (Gravenhorst). Unknown. Widely distributed in the county (but not common), with records from all VCs with the exception of VC65. Last record: Holmpton Cliff (VC61) in 2002; FEK det. MLD.

Liogluta microptera Thomson (= ***oblongiuscula*** (Sharp)). Unknown. Widely distributed in the county, with records from all VCs (only one from VC65). Most records, however, stem from the southern half of the county. Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Liogluta pagana (Erichson). Notable. There are seven records from six widely scattered Yorkshire localities: (VC61) Bubwith in 1913; WJF. (VC62) Saltburn in 1897; MLT. Scarborough on an unrecorded date; RL. Yedingham in 1932; GBW. (VC64) Studley in 1879; EAW. Malham in 1955 and 1957; WOS.

Philhygra (= ***Atheta***) ***arctica*** (Thomson). Local. Restricted to mountains and high moorland in north Wales, northern England and Scotland. There are records from five Yorkshire localities: (VC62) Spaunton Moor in 1987; YU det. MLD. Egton Moor in 1987; YU det. MLD. Fylingdales Moor in 1987; YU det. MLD. (VC63) West Nab in 1987; MLD. (VC64) Malham Tarn in 1993; MLD.

Philhygra (= ***Atheta***) ***britteni*** Joy. Notable. Restricted to north England (although there is a single record from Surrey) where it is found in wet habitats. Recorded from nine Yorkshire localities: VC61 (4), VC62 (2) and VC63 (3). Last record: Inkle Moor (VC63) in 2001; RM det. EJS.

Philhygra (= ***Atheta***) ***debilis*** (Erichson). Local. Recorded from 11 Yorkshire localities: VC62 (4), VC63 (6) and VC65 (1). Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Philhygra (= ***Atheta***) ***deformis*** (Kraatz). Notable. There are two Yorkshire records: (VC62) Scarborough on an unrecorded date; RL. (VC65) Semerwater in 1988; RJM.

Philhygra (= ***Atheta***) ***elongatula*** (Gravenhorst). Common. Widely distributed and common in the county with records from all VCs. Last record: Hall Garth Ponds, Ripon (VC65) in 2002; RJM.

Philhygra (= ***Atheta***) ***fallaciosa*** (Sharp). Local. Despite the national status of 'Local' there are only four county records: (VC61) Skipwith Common in 1989; RBA det. MLD. (VC62) Danby High Moor in 1987; YU det. MLD. May Moss in 1996; LA (teste MLD). (VC63) Thorne Moor in 1990; EN det. MLD.

Philhygra (= ***Atheta***) ***gyllenhali*** (Thomson). Common. Despite the national status of 'Common' the species has only been recorded from 13 Yorkshire localities: VC61 (3), VC62 (3), VC63 (6) and VC64 (1). Last record: Laytham (VC61) in 2000; RJM.

Philhygra (= ***Atheta***) ***hygrobia*** (Thomson). Notable. Associated with wet habitats. There are six widely scattered Yorkshire records: (VC61) Bubwith in the 1930s; GBW. Hornsea Mere in 1986; RJM (teste MLD). (VC62) Ashberry Pastures in 1972; EWA. (VC63) Blackmoorfoot Reservoir in 1989; MLD (teste CJ). Owston Wood in 1990; MLD. (VC64) Rudding Park in 1973; EWA det. CJ.

Philhygra (= ***Atheta***) ***hygrotopora*** (Kraatz). Unknown. Widely, but thinly, distributed in the county with records from all VCs (only one from VC61). Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Philhygra (= ***Atheta***) ***luridipennis*** (Mannerheim). Local. Widely, but thinly, distributed in Yorkshire with records from all VCs with the exception of VC65. Last record: Middleton Wood, Ilkley (VC64) in 2002; RJM.

Philhygra (= ***Atheta***) ***malleus*** Joy. Local. Widely distributed in the county with records from all VCs (only one from VC65). Last record: Cannon Hall (VC63) in 2001; MLD.

Philhygra (= ***Atheta***) ***melanocera*** (Thomson). Common. Widely distributed and common in Yorkshire (especially in the southern half of the county) with records from all VCs with

the exception of VC65. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Philhygra* (= *Atheta*) *obtusangula Joy. Local. Widely, but thinly, distributed in the county with records from all VCs (only one from VC61). Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Philhygra* (= *Atheta*) *palustris (Kiesenwetter). Unknown. Recorded from 13 Yorkshire localities: VC61 (3), VC62 (6), VC63 (3) and VC64 (1). Last record: Holmpton (VC61) in 2002; WRD det. MLD.

Philhygra* (= *Atheta*) *terminalis (Gravenhorst). pRDBK. Restricted to a handful of counties in England, Yorkshire being at the species' northern limit. Found on the banks of rivers and ponds, and other marshy habitats. The four county records are all in VC61: Bubwith in 1919; WJF and 1933; GBW. Wheldrake Ings in 1995 and 1996; both MLD. The statement that the 1919 captures were described as new to science (*Naturalist* **125**: 73) was given in error; they were new to Britain.

Philhygra* (= *Atheta*) *volans (Scriba). Unknown. With the exception of records from VC62 (in TA08) and VC65 (in SE19), the other Yorkshire records are from the southern half of the county: VC61 (4 localities) and VC63 (6). Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Dilacra* (= *Atheta*) *luteipes (Erichson). Unknown. Recorded from nine Yorkshire localities: VC61 (3), VC62 (1), VC63 (2) and VC64 (3). Last record: Staveley Lagoon (VC64) in 1995; MLD and RJM.

Dilacra* (= *Atheta*) *vilis (Erichson). Local. Despite the national status of 'Local' there are only four county records: (VC63) Sprotbrough in 1987; RJM (teste CJ). (VC64) Askham Bog in 1994; RGB and 1996; RGB and JAO. Staveley Lagoon in 1995; RJM.

Parameotica* (= *Atheta*) *difficilis (Brisout). Notable. Restricted to England where it is found in wetlands and marshes. With the exception of a record from VC62 (in SE87) the other Yorkshire records are all from localities in the Lower Derwent Valley (VC61). Last record: Wheldrake Ings (VC61) in 1991; MLD and RJM.

Enalodroma* (= *Atheta*) *hepatica (Erichson). Unknown. Recorded from ten Yorkshire localities: VC61 (1), VC62 (1), VC63 (4), VC64 (3) and VC65 (1). Last record: Haw Park (VC63) in 2003; WRD.

Bessobia* (= *Atheta*) *excellens (Kraatz). Local. Widely distributed in Yorkshire (especially in the northern half) with records from 13 localities: VC61 (1), VC62 (6), VC63 (2) and VC64 (4). Last record: Long Grain, Wykeham Forest (VC62) in 2000; LA det. MLD.

Bessobia* (= *Atheta*) *fungivora (Thomson). Local. Found in rotting fungi in the autumn. Recorded from 13 Yorkshire localities: VC61 (3), VC62 (4), VC63 (4) and VC64 (2). Last record: Kettlethorpe Woods (VC63) in 1999; MLD.

Bessobia* (= *Atheta*) *monticola (Thomson). Unknown. Widely, but thinly, distributed in the county with records from nine localities: VC61 (1), VC62 (2), VC63 (4) and VC64 (2). Last record: Brook Farm, Elstronwick (VC61) in 1996; WRD det. MLD.

Bessobia* (= *Atheta*) *occulta (Erichson). Local. Found in rotting fungi in the autumn. Recorded from seven Yorkshire localities: VC62 (3), VC63 (3) and VC65 (1). Last record: Hatfield Moor (VC63) in 1992; PS det. MLD.

Anopleta* (= *Atheta*) *corvina (Thomson). Common. Despite the national status of 'Common' the species has only been recorded from ten Yorkshire localities: VC62 (3), VC63 (5) and VC65 (2). Last record: Magdalen Wood (VC65) in 2002; RJM.

Anopleta* (= *Atheta*) *puberula (Sharp). pRDBK. Mainly restricted to southern England, but with occasional records north to northern Scotland. There is a single Yorkshire record: Rotherham (VC63) in 1989; WAE det. RJM.

Microdota* (= *Atheta*) *amicula (Stephens). Common. Widely distributed and common in the county with records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.

Microdota* (= *Atheta*) *atricolor (Sharp). Unknown. Widely, but thinly, distributed in Yorkshire with a small number of records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 1994; MLD.

Microdota* (= *Atheta*) *benickiella Brundin. Notable. Generally associated with woodland

although there are records from other habitats. There are two Yorkshire records, both from VC64: Studley on an unrecorded date; recorder unknown. Askham Bog in 1997; RGB.

Microdota (= ***Atheta***) ***boreella*** Brundin. Local. Despite the national status of 'Local' there is only a single county record: Blackmoorfoot Reservoir (VC63) in 1990; MLD (teste CJ).

Microdota (= ***Atheta***) ***indubia*** (Sharp). Local. Widely distributed in Yorkshire with records from all VCs. Last record: Sharow Mires (VC65) in 2002; RJM.

Microdota (= ***Atheta***) ***liliputana*** (Brisout). Local. Despite the national status of 'Local' there are only two Yorkshire records, both from VC63: Blackmoorfoot Reservoir in 1987; MLD (teste CJ). Linthwaite in 1990; MLD det. CJ.

Microdota (= ***Atheta***) ***minuscula*** (Brisout). Local. Found in litter in marshes and carrs. Despite the national status of 'Local' there is only a single Yorkshire record: Drop Clough (VC63) in 1988; DM det. CJ.

Microdota (= ***Atheta***) ***spatuloides*** Benick. pRDBK. Only recorded from Scotland and Yorkshire, where it is usually associated with woodland and pasture-woodland. There is a single county record: Duncombe Park (VC62) in 1985; RJM det. CJ.

Microdota (= ***Atheta***) ***subtilis*** (Scriba). Unknown. There are three Yorkshire records: (VC63) Wharncliffe Wood in 1988; EJS. (VC64) Bishop Wood in 1984; PJH. Askham Bog in 1969; EWA.

Cadaverota (= ***Atheta***) ***cadaverina*** (Brisout). Local. Despite the national status of 'Local' the species has only been recorded from 12 Yorkshire localities: VC62 (2) and VC63 (10). Last record: Dean Wood, Huddersfield (VC63) in 2001; MLD.

Oreostiba (= ***Atheta***) ***tibialis*** (Heer). Local. Found on mountains in northern England and Scotland. The nine Yorkshire records (from six localities) are all in the north-west of the county: (VC64) Malham Tarn in 1954 and 1957; WOS and 1993; MLD (teste CJ). Penyghent in 1967; CJ and 1981; JAO. (VC65) Birkdale Tarn in 1913; MLT. Gaping Ghyll in the 1930s; GBW. Aysgarth in 1991; RBA det. CJ.

Mocyta (= ***Atheta***) ***amplicollis*** (Mulsant & Rey). Unknown. Widely distributed in Yorkshire with records from all VCs (only one from VC65). Most records, however, stem from the southern half of the county. Last record: Woolley Park (VC63) in 2002; AG det. MLD.

Mocyta (= ***Atheta***) ***clientula*** (Erichson). Local. Past confusion with other members of the genus renders the following records unreliable without voucher specimens: (VC61) Spurn in the mid-20th century (WOS), (VC62) Robin Hood's Bay in 1935 (recorder unknown), Goathland in 1935 (HB), Whitby in the 1930s (HB) and Mulgrave Wood in the 1930s (HB). The only authentic records are from: (VC61) Spurn in 1990; MLD. (VC63) Birstall in 1969; EWA (teste CJ). Blackmoorfoot Reservoir in 1984; MLD. Sprotbrough in 1985; RJM (teste MLD). (VC64) Tockwith in 1969; EWA. Askham Bog in 1994 and 1997; RGB.

Mocyta (= ***Atheta***) ***fungi*** (Gravenhorst). Common. Widely distributed and common in the county, with numerous records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Mocyta (= ***Atheta***) ***gilvicollis*** (Scheerpeltz). Unknown. There are three Yorkshire records: (VC62) Runswick Bay in 1990; MLD det. CJ. Wydale Hall in 1994; LA det. MLD. (VC63) Thorne Moor in 1969; CJ.

Mocyta (= ***Atheta***) ***orbata*** (Erichson). Unknown. There are records from 11 Yorkshire localities, all in the southern half of the county: VC61 (2) and VC63 (9). Last record: Bole Hills (VC63) in 2000; EJS.

Mocyta (= ***Atheta***) ***orphana*** (Erichson). Notable. Mainly confined to southern Britain, Yorkshire being at the species' northern limit. The single county record is from Wheldrake Ings (VC61) in 1985; RGB det. JM.

Rhagocneme (= ***Atheta***) ***subsinuata*** (Erichson). Unknown. There are six county records: (VC61) Boynton in 1972; EWA. (VC62) north of Pickering in 1969; EWA. (VC63) Birstall in 1969; EWA. Almondbury in 1985; DM det. MLD (teste CJ). Blackmoorfoot Reservoir in 1999; MLD. (VC64) North Stainley in 1967; EWA.

Datomicra (= ***Atheta***) ***canescens*** (Sharp). Common. Found in dung. Despite the national

status of 'Common' there is only a single Yorkshire record: Eggborough (VC63) in 1985; RJM (teste CJ).

Datomicra* (= *Atheta*) *celata (Erichson). Local. Widely distributed with numerous records from all VCs. Last record: Nostell Priory (VC63) in 2003; MLD.

Datomicra* (= *Atheta*) *dadopora Thomson. Local. Recorded from 24 Yorkshire localities: VC61 (2), VC62 (5), VC63 (12), VC64 (3) and VC65 (2). Last record: Marfield Quarry, Masham (VC65) in 2002; RJM.

Datomicra* (= *Atheta*) *nigra (Kraatz). Common. Widely distributed and common in the county with numerous records from all VCs. Last record: Nostell Priory (VC63) in 2003; MLD.

Datomicra* (= *Atheta*) *sordidula (Erichson). Local. Found in dung. Widely distributed in Yorkshire, with records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.

Datomicra* (= *Atheta*) *zosterae (Thomson). Notable. Associated with wetlands. Predominantly southern in distribution, although there are records from Scotland. There are two county records, both from VC61: Aughton Ings in 1988; RJM (teste CJ). Wheldrake Ings in 1989; RJM (teste CJ).

Atheta aeneicollis (Sharp) (= ***pertyi*** (Heer)). Unknown. Widely distributed and common in the county with numerous records from all VCs. Last record: Nostell Priory (VC63) in 2003; MLD.

Atheta aquatica (Thomson). Common. Widely distributed in the county with records from all VCs (only one from VC65) but, rather surprisingly, there are none from the eastern half of VC61. Last record: T.P. Wood, Marsh (VC63) in 2002; MLD.

Atheta aquatilis (Thomson). Notable. Restricted to wetlands. Despite the national status of 'Notable', the species is widely distributed in VC62, 63 and 65. There are, however, only single records from both VC61 and 64. Last record: T.P. Wood, Marsh (VC63) in 2002; MLD.

Atheta brunneipennis (Thomson). Local. Recorded from 21 Yorkshire localities: VC61 (2), VC62 (4), VC63 (12) and VC64 (3). Last record: Dean Wood, Huddersfield (VC63) in 2001; MLD.

Atheta castanoptera (Mannerheim). Common. Widely distributed and common in the county with numerous records from all VCs. Rather surprising, however, is the lack of records from the eastern half of VC61. Last record: Nostell Priory (VC63) in 2003; MLD.

Atheta graminicola (Gravenhorst). Common. Widely distributed and common in the county with numerous records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Atheta hypnorum (Kiesenwetter). Local. Recorded from 19 Yorkshire localities: VC61 (1), VC62 (6), VC63 (10) and VC64 (2). Last record: Wykeham Forest (VC62) in 2001; LA (teste MLD).

Atheta incognita (Sharp). Unknown. Recorded from five Yorkshire localities: (VC62) Ellers Springs in 1995; LA (teste MLD). May Moss in 1996; LA det. MLD. Long Grain, Wykeham Forest in 2000; LA det. MLD. (VC63) Rivelin in 1993; EJS (teste MLD). Potteric Carr (YWT reserve) in 2001; MLD.

Atheta triangulum (Kraatz). Local. Despite the national status of 'Local' the species is widely distributed and common in Yorkshire with records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.

Atheta xanthopus (Thomson). Common. Widely distributed in Yorkshire, especially in the southern half of the county, with records from all VCs (only one from VC65). Last record: Sharow Mires (VC65) in 2002; RJM.

Atheta basicornis (Mulsant & Rey). Notable. Restricted to England where it is associated with wet habitats. There are three county records: (VC63) Thorne Moor in 1985; RJM (teste CJ). (VC64) Askham Bog in 1996; RGB and JAO. (VC65) Sharow Mires, Ripon in 2002; RJM.

Atheta britanniae Bernhauer & Scheerpeltz. Unknown. Recorded from 24 Yorkshire localities: VC61 (3), VC62 (5), VC63 (12), VC64 (2) and VC65 (2). Last record: Upper

Stone Wood, Shepley (VC63) in 2003; MLD.

Atheta coriaria (Kraatz). Common. Widely distributed in Yorkshire but not recorded from VC65 or, more surprisingly, the eastern half of VC61. Last record: Nostell Priory (VC63) in 2003; MLD.

Atheta crassicornis (Fabricius). Common. Found in a number of differing habitats. The species is ubiquitous in the county, with numerous records from all VCs. Last record: Lower Stone Wood, Shepley (VC63) in 2003; MLD.

Atheta diversa (Sharp). Notable. Widely distributed in Scotland with a single record from England: Wessenden Head (VC63) in 1984; MLD (teste CJ).

Atheta divisa (Maerkel). Unknown. There are two Yorkshire records: (VC61) Bubwith in 1919; CES. (VC64) Queen Mary's Dub in 1968; CJ.

Atheta euryptera (Stephens). Common. Despite the national status of 'Common' the species has only been recorded from six Yorkshire localities: (VC61) Spurn in 1990; MLD det. CJ. (VC62) Whitby on an unrecorded date; recorder unknown. Egton in the 1930s; HB. (VC63) Shirley Pool in 1911; recorder unknown. Thorne Moor in 1971; CJ. (VC64) Fairburn in 1987; MLD (teste CJ).

Atheta fungicola (Thomson). Common. Despite the national status of 'Common' the species has only been recorded from seven Yorkshire localities: VC62 (4), VC63 (2) and VC64 (1). Last record: Highcliffe (VC63) in 2000; EJS (teste MLD).

Atheta harwoodi Williams. Local. Widely distributed in the county with records from all VCs. Last record: Sandall Beat Wood (VC63) in 2002; RJM.

Atheta intermedia (Thomson). Unknown. Found in dung. There are four county records: (VC61) Spurn in 2001; MLD. (VC63) Elland Park Wood in 1985; EJS. Swinden Plantation in 1988; EJS. (VC64) Malham Tarn in 1954; WOS.

Atheta liturata (Stephens). Local. Recorded from 13 Yorkshire localities (mainly in the western half of the county): VC62 (1), VC63 (4), VC64 (4) and VC65 (4). Last record: Sharow Mires, Ripon (VC65) in 2002; RJM.

Atheta nidicola (Johansen). Unknown. There are four county records: (VC62) Dalby Forest in 1966; GS. (VC63) Blackbrook Wood in 1992; EJS (teste CJ). Ewden Pond in 1997; EJS (teste MLD). (VC64) Askham Bog in 1967; CJ.

Atheta nigricornis (Thomson). Local. Widely distributed in the county, but not recorded from VC65 or, more surprisingly, the eastern half of VC61. Last record: Nostell Priory (VC63) in 2003; MLD.

Atheta nigritula (Gravenhorst). Notable. Mainly restricted to southern England, but with scattered records north to south-east Scotland. Generally associated with woodland, there are three Yorkshire records: (VC61) Skipwith Common in 1993; MLD. (VC63) Wharncliffe Wood in 1992; EJS (teste CJ). Rivelin in 1998; EJS (teste MLD).

Atheta oblita (Erichson). Unknown. There are four county records: (VC61) Potter Brompton in 1986; RJM (teste CJ). (VC62) Saltburn in 1897; MLT. May Moss in 1996; LA det. MLD. (VC63) Toftwood, Rivelin in 2000; EJS (teste MLD).

Atheta paracrassicornis Brundin. pRDBK. A single male of this boreo-alpine species collected at Malham Tarn (VC64) by CJ in 1967 added the species to the British list. A full account can be found in *Entomologist* **101**: 64-66. There have been no further records (either Yorkshire or British) since this time.

Atheta pilicornis (Thomson). Notable. Associated with woodland in England and southern Scotland. There is a single Yorkshire record: Saltburn (VC62) in 1893; MLT.

Atheta ravilla (Erichson). Unknown. Found in carrion. Widely distributed in the county with records from all VCs (only one from VC65). Last record: T.P. Wood, Marsh (VC63) in 2001; MLD.

Atheta strandiella Brundin. Notable. Not added to the British list until 1971 (*Ent. Monthly Mag.* **107**: 153-157), the species has now been recorded from parts of England and northern Scotland. There is a single Yorkshire record: Spurn (VC61) in 1990; MLD det. CJ.

Mycetota* (= *Atheta*) *laticollis (Stephens). Common. Widely distributed and common in Yorkshire with numerous records from all VCs. Last record: Nostell Priory (VC63) in

2003; MLD.

Dimetrota* (= *Atheta*) *aeneipennis (Thomson). Local. Generally associated with deer dung. Despite the national status of 'Local' there are only three Yorkshire records, all from VC63: Abbey Brook in 1987; EJS (teste CJ). Bradfield in 1988; EJS (teste CJ). Strines in 1989; EJS (teste CJ).

Dimetrota* (= *Atheta*) *atramentaria (Gyllenhal). Common. Usually associated with ungulate dung and rotting vegetation. The species is ubiquitous in the county, with numerous records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Dimetrota* (= *Atheta*) *cauta (Erichson). Common. Despite the national status of 'Common' there are only two Yorkshire records: (VC61) Spurn in the mid-20th century; recorder unknown. (VC64) Ringhay Wood in 1989; RBA det CJ.

Dimetrota* (= *Atheta*) *cinnamoptera (Thomson). Unknown. Recorded from 26 Yorkshire localities: VC62 (10), VC63 (11), VC64 (2) and VC65 (3). Last record: Sandall Beat Wood (VC63) in 2002; RJM.

Dimetrota* (= *Atheta*) *ischnocera Thomson. Unknown. Widely distributed in the county with records from all VCs with the exception of VC65 (only one record for VC61). Last record: Toftwood, Rivelin (VC63) in 1998; EJS.

Dimetrota* (= *Atheta*) *laevana (Mulsant & Rey). Local. Found in dung. Recorded from 17 Yorkshire localities: VC62 (5), VC63 (7), VC64 (4) and VC65 (1). Last record: Duncombe Park (Beech Wood) (VC62) in 2000; RJM.

Dimetrota* (= *Atheta*) *marcida (Erichson). Local. Although widely distributed and commonly recorded from VC63, the only other county records are from localities in VC62 (5), VC64 (3) and VC65 (1). Last record: Upper Stone Wood, Shepley (VC63) in 2002; MLD.

Dimetrota* (= *Atheta*) *nigripes (Thomson). Common. Widely distributed in Yorkshire with numerous records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.

Dimetrota* (= *Atheta*) *setigera (Sharp). Common. Widely, but thinly, distributed in the county with records from all VCs (only one from VC65). Last record: Danthorpe (VC61) in 2001; WRD det. MLD.

Badura* (= *Atheta*) *macrocera (Thomson). Local. Widely, but thinly, distributed in the county with records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.

Chaetida* (= *Atheta*) *longicornis (Gravenhorst). Common. Widely distributed and common in Yorkshire with numerous records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Thinobaena* (= *Atheta*) *vestita (Gravenhorst). Common. Confined to the shoreline where it is found in litter. Recorded along the full length of the Yorkshire coast, from Redcar (VC62) in the north to Spurn (VC61) in the south; also along the Humber Estuary as far as Hessle (TA02). A most unusual inland record concerned a female at Aughton Ings (VC61) in 1988; MLD det. CJ. Last record: Spurn (VC61) in 2000; RM det. EJS (teste MLD).

Coprothassa* (= *Atheta*) *melanaria (Mannerheim). Local. Found in dung. There are four county records: (VC61) Spurn in 1950; WOS and 1990; MLD. (VC62) Scarborough on an unrecorded date; RL. Ravenscar on an unrecorded date; WJF.

Acrotona* (= *Atheta*) *aterrima (Gravenhorst). Common. Widely distributed and common in the county with records from all VCs (only one from VC65). Last record: Nostell Priory (VC63) in 2003; MLD.

Acrotona* (= *Atheta*) *exigua (Erichson). Unknown. There is a single Yorkshire record: Holme Moss (VC63) in 1983; CJ.

Acrotona* (= *Atheta*) *muscorum (Brisout). Common. Widely distributed and common in the county with records from all VCs (only one from VC65). Last record: Blackmoorfoot Reservoir (VC63) in 2002; MLD.

Acrotona* (= *Atheta*) *obfuscata (Gravenhorst). Notable. A species of wet habitats. Mainly confined to southern Britain, Yorkshire being at the species' northern limit. The only county records are from Hillsborough (VC63) in 1989 and 1990; EJS det. CJ.

Acrotona* (= *Atheta*) *parvula (Mannerheim). Common. Found in dung. Widely distributed and common in Yorkshire with records from all VCs. Last record: Blackmoorfoot Reservoir (VC63) in 2003; MLD.

Acrotona* (= *Atheta*) *pygmaea (Gravenhorst). Local. Recorded from 17 Yorkshire localities: VC61 (1), VC63 (10) and VC64 (6). Last record: Whiteley Wood (VC63) in 2000; EJS det. MLD.

Halobrecta algae (Hardy). Unknown. There are two Yorkshire records, both from VC61: Welwick in 1947; WOS. Spurn in the mid-20th century; WDH.

Halobrecta flavipes Thomson. Unknown. There are seven Yorkshire records (from six localities): (VC61) Welwick in 1947; WOS. Spurn in the mid-20th century; WDH and 1996; MLD det. CJ. South Landing, Flamborough in 1987; MLD det. CJ. (VC62) Saltburn on an unrecorded date; MLT. Grangetown on an unrecorded early 20th century date; GBW. Scarborough on an unrecorded early 20th century date; GBW.

Alianta incana (Erichson). Local. Found in litter in damp places. Widely distributed in the southern half of the county with occasional records in the northern half. Recorded from 24 localities: VC61 (5), VC62 (2), VC63 (14), VC64 (2) and VC65 (1). Last record: Hall Garth Ponds, Ripon (VC65) in 2002; RJM.

Pachnida nigella (Erichson). Local. A predominantly southern species which is found in marshy places. Widely distributed in the southern half of the county, with three records from the northern half. Recorded from 33 localities: VC61 (6), VC62 (1), VC63 (22), VC64 (3) and VC65 (1). Last record: Hall Garth Ponds, Ripon (VC65) in 2002; RJM.

Trichiusa immigrata Lohse. Unknown. This immigrant species was first discovered in Britain during 1992 when specimens were found in Kent (*Coleopterist* **2** (1): 18) and by the end of 1994 it had spread north to Leicestershire (*Coleopterist* **4** (1): 14). The species continued its northward extension and was first recorded in Yorkshire at Elstronwick (VC61) in May 1996; WRD det. MLD. Since that time there have been records from a further 11 Yorkshire localities (with the exception of a record from VC65 all the others are from the southern half of the county): VC61 (4 localities), VC63 (7) and VC65 (1). The most northerly record is from Marfield Quarry, Masham (SE28) in 2002; RJM. I know of no records further north than those above.

Thamiaraea cinnamomea (Gravenhorst). Local. There is a single Yorkshire record: Blackmoorfoot Reservoir (VC63) in 1985; MLD (teste CJ).

Thamiaraea hospita (Maerkel). Notable. Found in broad-leaved woodland and pasture-woodland. Restricted to southern England, with scattered records further north (not recorded from Scotland). There is a single Yorkshire record: Scarborough (VC62) on an unrecorded date; recorder unknown.

Aleochara bilineata Gyllenhal. Common. Widely distributed in the south and east of the county with records from 13 localities: VC61 (5), VC62 (5) and VC63 (3). Last record: Manor Farm, Eddlethorpe (VC61) in 2000/2001; RGL det. MLD.

Aleochara binotata Kraatz. pRDBK. A single female from Spurn (VC61), collected by RCW in 1963, was originally described as *A. verna* Say (*Entomologist* **102**: 207-209). The true identity of the species has now been correctly determined and further details can be found in *Ent. Record* **107**: 225-226. This was the first British record. Only four other British specimens have been located: two taken prior to this date and two more recently (*Coleopterist* **6** (1): 34).

Aleochara bipustulata (Linnaeus). Common. The realisation that more than one species was masquerading under this name (*Coleopterist* **6** (1): 1-45) means that without specimens all records on the YNU database are suspect. Dissection of available and more recent specimens, however, has indicated that the species is widely distributed in the county with records from all VCs. Last record: Scorton Quarry (VC65) in 2002; RJM.

Aleochara verna Say. pRDBK. Recorded from seven Yorkshire localities: VC61 (3), VC62 (2), VC63 (1) and VC64 (1). A revision of the subgenus *Coprochara* by RCW (*Coleopterist* **6** (1): 1-45) has indicated that the species is far more widespread in the British Isles than previously thought. Prior to this revision the species had only been recorded from the

Hebrides (Outer and Inner) and afforded the national status of pRDBK; this will obviously require revising. Last record: Blackmoorfoot Reservoir (VC63) in 2001; MLD.

Aleochara curtula (Goeze). Common. Found throughout the British Isles (with the exception of northern Scotland), this is the most common carrion-frequenting British member of the genus. Widely distributed and common in the county with numerous records from all VCs. Last record: Nosterfield Quarry (VC65) in 2002; RJM.

Aleochara brevipennis Gravenhorst. Notable. Found throughout the British Isles where it appears to be hygrophilous. There is a single Yorkshire record: Bretton Park (VC63) in 1981; MLD.

Aleochara intricata Mannerheim. Unknown. Widely distributed throughout the British Isles, but apparently absent from northern Scotland. Recorded from nine widely scattered Yorkshire localities: VC61 (3), VC62 (3), VC63 (1) and VC64 (2). Last record: Rawcliffe Meadow (VC62) in 1997; MLD.

Aleochara cuniculorum Kraatz. Local. Generally found in rabbit burrows, with records throughout the British Isles as far north as the Outer Hebrides. Recorded from six Yorkshire localities: (VC61) Skipwith Common in 1919; WJF. Spurn in the mid-20th century; WOS and 1963; RCW. (VC63) Blackmoorfoot Reservoir in 1987; MLD (teste CJ). (VC64) Kearby in 1937; CET. Askwith in 1937; CET. (VC65) Nosterfield N.R. in 2002; RJM (teste MLD).

Aleochara discipennis Mulsant & Rey. Notable. Predominantly southern in distribution but with occasional records in northern Britain. There is a single Yorkshire record: Roche Abbey (VC63) in 1986; WAE det. CJ.

Aleochara fumata Gravenhorst. pRDBK. Generally found in fungi, although there are records from carrion and an owl's nest. Mainly confined to south-east England, but there are a few records from northern England and Scotland. There are two county records, both from VC63: Newmillerdam in 1966; EWA (teste RCW). Hatfield Moor in 1991; PS det. MLD.

Aleochara funebris Wollaston. Unknown. Probably widely distributed throughout the British Isles where it is found in a diverse range of habitats. There are Yorkshire records from 12 widely scattered localities: VC61 (1), VC62 (2), VC63 (7) and VC65 (2). Last record: Blackmoorfoot Reservoir (VC63) in 2001; MLD.

Aleochara inconspicua Aube. pRDBK. The larvae are parasitic in the puparia of the wheat bulb fly. Restricted to about ten widely scattered English localities. There is a single Yorkshire record: Thorne Moor (VC63) in 1990; EN det. CJ.

Aleochara kamila Likovsky. Notable. Little is known about the British distribution as problems with nomenclature have clouded the picture. It is possible that it may be a southern species which is found north to Yorkshire. Without specimens for confirmation previous records (as *A. diversa* Sahlberg) are unreliable. The only authentic records are from: (VC62) May Moss in 1996; LA det. MLD. (VC63) Drop Clough in 1987; MLD. Willowgarth, Knottingley (YWT reserve) in 1992; RJH det. MLD (teste CJ) and 1993; RJH det. MLD.

Aleochara lanuginosa Gravenhorst. Common. Almost ubiquitous in cow dung throughout the British Isles. It is also found in a number of other habitats. Widely distributed and common in Yorkshire, with numerous records from all VCs. Last record: Scorton Quarry (VC65) in 2002; RJM.

Aleochara lygaea Kraatz. RDB I. Predominantly southern in distribution, with old records north to south-west Scotland. There are two county records, both from VC62: Saltburn in 1898; MLT. Acklamb in 1925; MLT.

Aleochara moerens Gyllenhal. Notable. Recorded throughout the British Isles and typically associated with fungi. There is a single Yorkshire record: Langsett (VC63) in 1985; EJS (teste CJ).

Aleochara sparsa Heer. Common. Past confusion with identification renders the 16 pre-1960 Yorkshire records unreliable without voucher specimens. Authentic records (all since 1985) stem from eight localities: VC61 (2), VC62 (2), VC63 (3) and VC65 (1). Last

record: Dale Dyke (VC63) in 1998; EJS.

Aleochara villosa Mannerheim. pRDBK. Widely scattered in England with occasional records from Scotland. Found in a wide variety of rotting vegetable matter and dung. The only Yorkshire record involves numerous specimens from dovecotes in the Scarborough area (VC62) in 1930; RLF and GBW. Most specimens in British collections originate from this source (*Coleopterist* **6** (1): 41-42).

Aleochara ruficornis Gravenhorst. Notable. Widely distributed in England and southern Scotland where it has been recorded from a variety of habitats (although woodland appears to provide its main habitat). Recorded in Yorkshire from 15 widely scattered localities: VC61 (3), VC62 (6), VC63 (3) and VC64 (3). Last record: Pot Ridings Wood (VC63) in 2002; EJG det. MLD.

Aleochara spadicea (Erichson). Unknown. Present throughout the British Isles, although most records are from southern Britain. The species is found in the subterranean nests of the mole. Recorded from 13 Yorkshire localities, most being in the eastern half of the county: VC61 (5), VC62 (6), VC63 (1) and VC64 (1). Last record: Cawood (VC64) in 1995; KGP det. MLD.

Aleochara grisea Kraatz. Unknown. This littoral species is widely distributed in seaweed and carrion around the coasts of the British Isles. There are records from four Yorkshire localities: (VC61) Spurn on a number of occasions between 1950 and 2001; WOS, RCW *et al*. Kilnsea in 1999; WRD (teste MLD). (VC62) Saltburn on an unrecorded date; MLT. Redcar on unrecorded dates; MLT and WJF det. EAN.

Aleochara punctatella Motschulsky. Unknown. A littoral species which is widely distributed around the coasts of the British Isles. There are records from six Yorkshire localities: (VC61) Bridlington in 1909; WES. Spurn in the mid-20th century; WOS and 1984; MLD. (VC62) Saltburn on an unrecorded date; MLT. Scarborough on an unrecorded date; JHB. Grangetown in 1913; WJF det. EAN. Teesmouth in 1915; GBW.

Aleochara obscurella Gravenhorst. Unknown. Widely distributed around the coasts of the British Isles (a littoral species which is found in seaweed and carrion). Recorded along the full length of the Yorkshire coast, from Saltburn (VC62) in the north to Spurn (VC61) in the south; also along the Humber Estuary as far as Sunk Island (TA21). Last record: Spurn (VC61) in 1999; WRD (teste MLD).

Tinotus morion (Gravenhorst). Common. Found in moss and leaf litter. Widely, but thinly, distributed in the county with records from all VCs. Last record: Marfield Quarry, Masham (VC65) in 2002; RJM.

Drusilla canaliculata (Fabricius). Common. Widely distributed in the county with numerous records from all VCs. Last record: Wath Manvers (VC63) in 2002; MLD.

Zyras humeralis (Gravenhorst). Local. Associated with ants. Widely, but thinly, distributed in the county with records from nine localities: VC61 (1), VC62 (4), VC63 (3) and VC65 (1). Last record: Scar Wood (VC62) in 1988; DAL.

Lomechusa emarginata (Paykull). Notable. Restricted to England, where it occurs in the nests of a number of ant species. There are six Yorkshire records from five localities, all in VC63: Rossington in 1908; HHC. Dalton Bank, Huddersfield in 1910 and 1916; SLM. Doncaster in 1913; HHC. Huddersfield in 1917; SLM. Anston Stones Wood in 1985; WAE (teste MLD).

Cordalia obscura (Gravenhorst). Unknown. Recorded from five Yorkshire localities: (VC unknown) York district on an unrecorded mid-20th century date; WDH. (VC62) Cloughton in 1914; WDH. Whitby in 1935; HB. (VC63) Mag Wood in 1983; DM det. MLD (teste CJ). (VC64) Cawood in 1990; MLD.

Falagrioma* (= *Falagria*) *thoracica Stephens. Local. Despite the national status of 'Local' there are only two Yorkshire records: (VC62) Saltburn on an unrecorded early 20th century date; MLT. (VC63) Wentbridge in 1879; recorder unknown.

Falagria caesa Erichson. Unknown. With the exception of a record from a VC64 locality (in SE24), the other Yorkshire localities are in VC62 (5) and VC63 (12). Last record: South Hiendley Common (VC63) in 2000; MLD.

Falagria sulcatula (Gravenhorst). Notable. Confined to England where it is found in wetlands (including brackish wetlands). There are two Yorkshire records, both from VC63: Royd House Wood in 1984; DM det. MLD. Blackmoorfoot Reservoir in 1985; MLD.
Myrmecopora sulcata (Kiesenwetter). Unknown. There are four Yorkshire records: (VC61) Spurn in 1919 and during the mid-20th century; recorders unknown. (VC62) Saltburn in 1896; MLT. Scarborough on an unrecorded date; TW.
Myrmecopora uvida (Erichson). Unknown. There is a single county record: Saltburn (VC62) in 1896; MLT.
Autalia impressa (Olivier). Common. Found in decaying gill fungi. Widely distributed and common in Yorkshire with records from all VCs but, rather surprisingly, not recorded from the eastern half of VC61. Last record: Magdalen Wood (VC65) in 2002; RJM.
Autalia longicornis Scheerpeltz. Common. With the exception of records from VC62 (in SE98) and VC65 (in SE27), the other Yorkshire records are all in the southern half of the county: VC61 (1), VC63 (10) and VC64 (3). Last record: Upper Stone Wood, Shepley (VC63) in 2002; MLD.
Autalia puncticollis Sharp. Common. Despite the national status of 'Common' there are only three Yorkshire records: (VC64) Malham in 1954 and 1957; WOS. (VC65) Rowton Beck in 1981; PS.
Autalia rivularis (Gravenhorst). Common. Found in herbivore dung and decaying plant material. Widely distributed and common in Yorkshire with records from all VCs. Last record: Nostell Priory (VC63) in 2003; MLD.
Encephalus complicans Stephens. Local. Found in moss etc. Widely distributed in the county (only one record from VC65) but, rather surprisingly, there are no records from the eastern half of VC61. Last record: Foxglove N.R., Waithwith (VC65) in 2001; WRD.
Gyrophaena affinis Mannerheim. Common. Found in fungi. Thinly distributed in the county, but not recorded from VC65. Last record: Dean Wood, Huddersfield (VC63) in 2001; MLD.
Gyrophaena angustata (Stephens). Notable. Despite the national status of 'Notable' this is a widely distributed and frequently recorded species in Yorkshire (from all VCs). There are records from 26 localities: VC61 (3), VC62 (5), VC63 (9), VC64 (8) and VC65 (1). Last record: Ripon Canal (VC64) in 2002; RJM.
Gyrophaena bihamata Thomson. Unknown. Found on fungi, particularly bracket fungi on trees, often in large numbers. There are nine Yorkshire records from eight localities (mainly in the southern half of the county): VC61 (2), VC63 (4) and VC64 (2). Last record: Breary Marsh (VC64) in 1999; RJM.
Gyrophaena fasciata (Marsham). Local. Associated with damaged or decaying fungi. Widely distributed in Yorkshire with records from all VCs with the exception of VC65. Last record: Burton Bushes (VC61) in 1999; WRD (teste MLD).
Gyrophaena gentilis Erichson. Common. Found in fungi. Widely distributed in Yorkshire with records from all VCs. Last record: Magdalen Wood (VC65) in 2002; RJM.
Gyrophaena joyi Wendeler. Notable. Associated with marshy habitats. There are two Yorkshire records: (VC64) Willow Garth, Ripon (YWT reserve) in 2002; RJM (teste MLD). (VC65) Sharow Mires, Ripon in 2002; RJM (teste MLD).
Gyrophaena joyioides Wuesthoff. Notable. Mainly restricted to southern England where it is found in fungi in woodland. There are five Yorkshire records: (VC63) Rivelin in 1993; EJS (teste MLD). (VC64) Hetchell Wood in 1989; RBA det. MLD (teste CJ). Ringhay Wood in 1993; RJH det. MLD. Upper Dunsforth Carrs in 1999; MLD. Breary Marsh in 1999; MLD.
Gyrophaena minima Erichson. Unknown. Found in fungi. Widely, but thinly, distributed in Yorkshire with a small number of records from all VCs. Last record: Forge Valley (VC62) in 2000; RJM.
Gyrophaena nana (Paykull). Common. Found in fungi. Despite the national status of 'Common' there are only three authentic Yorkshire records: (VC63) Torne Bridge in 1969; EWA. (VC64) Bolton Percy in 1943; recorder unknown. (VC65) Cover Banks, Middleham

in 1992; RJM. Past confusion with other members of the genus renders the early 20th century records from VC61 (Skipwith Common and Allerthorpe Common; both WJF) unreliable without voucher specimens.

Gyrophaena poweri Crotch. pRDBK. Chiefly found in fungi on trees. Predominantly southern in distribution. The only Yorkshire, and the most northerly record, being from Rudston (VC61) in 1989; MLD.

Gyrophaena strictula Erichson. Notable. Confined to England and south-west Scotland where it is associated with the hard fungus *Daedalaea quercina* on oak. There are four authentic Yorkshire records, all from VC63: Hallfield Dore in 1995; EJS (teste MLD). Booth Wood, Wortley in 1995; EJS. Damflask in 1995; EJS. Wharncliffe Wood in 1999; EJS. Past confusion with other members of the genus renders a 1886 record from Scarborough (ECH) unreliable without a voucher specimen.

Gyrophaena williamsi Strand. Notable. Predominantly southern in distribution, the most northerly records being from Bottom's Mill Wood (VC63) in 1985; DM det. MLD and Harlow Carr Gardens (VC64) in 1972; EWA.

Agaricochara* (= *Gyrophaena*) *latissima (Stephens). Local. Found in fungi. Widely distributed in the county with records from all VCs. Most records, however, stem from the southern half of the county. Last record: Sandall Beat Wood (VC63) in 2002; WRD and RJM.

Homalota plana (Gyllenhal). Unknown. Found under bark. Widely distributed in the county, but not recorded from VC65 or, more surprisingly, the eastern half of VC61. Last record: Nostell Fish Ponds (VC63) in 2000; MLD.

Anomognathus cuspidatus (Erichson). Common. Found under bark. Despite the national status of 'Common' the species has only been recorded from 12 widely scattered Yorkshire localities: VC62 (5), VC63 (6) and VC65 (1). Last record: Beaumont Park, Huddersfield (VC63) in 2002; MLD.

Thecturota marchii (Dodero). Naturalised. There is a single Yorkshire record: Slaithwaite Tip (VC63) in 1948; EWA.

Leptusa fumida (Erichson). Common. Found under bark and in fungi. Widely distributed in the county (only one record for VC65) but, rather surprisingly, not recorded from the eastern half of VC61. Last record: Orange Wood, Blackmoorfoot (VC63) in 2003; MLD.

Leptusa norvegica Strand. Notable. Found under bark (both deciduous and evergreen). Mainly confined to Scotland but with scattered records throughout the rest of Britain. There are four Yorkshire records: (VC62) Langdale Rigg in 1979; RSK det. MLD. Troutdale in 1989; RSK det. MLD. Hagg Wood Marsh in 1989; MLD. (VC63) Elland Park Wood in 1987; MLD (teste CJ). Specimens from Malham (VC64) in 1954 and 1957 (*Naturalist* **83**: 13), described as new for Yorkshire, have proved to be *L. fumida* Kraatz.

Leptusa pulchella (Mannerheim). Local. Found under dead conifer bark. Recorded from 17 widely scattered Yorkshire localities: VC62 (4), VC63 (10), VC64 (2) and VC65 (1). Last record: Foxglove N.R., Waithwith (VC65) in 2002; RJM.

Leptusa ruficollis (Erichson). Unknown. Widely, but thinly, distributed in the county with records from all VCs. Last record: Orange Wood, Blackmoorfoot (VC63) in 2003; MLD.

Heterota plumbea (Waterhouse). Notable. A coastal species (mainly along the south coast) with a single Yorkshire record: Spurn (VC61) in 1984; MLD.

Bolitochara bella Maerkel. Local. Found in fungi and fungoid wood. Despite the national status of 'Local' there are only four Yorkshire records (from three localities): (VC61) Brook Farm, Elstronwick in 2001; WRD (teste MLD) and 2002; WRD. (VC63) Lepton Great Wood in 1985; DM det. MLD (teste CJ). (VC64) Malham in 1957; WOS.

Bolitochara lucida (Gravenhorst). Local. Found in fungi and fungoid wood. Widely distributed in the county, but not recorded from VC65 or, more surprisingly, the eastern half of VC61. Last record: Middleton Wood, Ilkley (VC64) in 2002; RJM (teste MLD).

Bolitochara mulsanti Sharp. Notable. Located in decaying fungus and under fungus infected bark in broad-leaved and coniferous woodland. A northern species, south to Yorkshire. There are seven widely scattered Yorkshire records: VC62 (3), VC63 (3) and

VC65 (1). Last record: Cover Banks, Middleham (VC65) in 1992; RJM.

Bolitochara obliqua Erichson. Common. Found in fungi throughout Britain. Widely distributed and common in Yorkshire, with records from all VCs. Last record: Orange Wood, Blackmoorfoot (VC63) in 2003; MLD.

Bolitochara pulchra (Gravenhorst). Notable. A woodland species that is more widely distributed in Scotland than further south. There is a single Yorkshire record: Doncaster district (VC63) on an unrecorded mid-20th century date; HHC.

Placusa depressa Maeklin. Notable. Generally found under the bark of pine trees. A predominantly northern species, although there are records from south-east England. There are three Yorkshire records: (VC62) Rawcliffe Meadows in 1997; MLD. (VC63) Stocksmoor (YWT reserve) in 1971; EWA. Wharncliffe Wood in 1987; EJS (teste CJ).

Placusa tachyporoides (Waltl). Notable. Restricted to England where it is found under bark in deciduous woodland and pasture-woodland. There is a single Yorkshire record: Bishop Wood (VC64) in 1985; PK det. RJM.

Phytosus balticus Kraatz. Local. Generally found under felts of green algae on the shore. There are five Yorkshire records from four localities: (VC61) Spurn in the mid-20th century; WOS and 1963; RCW. (VC62) Scarborough on an unrecorded date; recorder unknown. Eston in 1909; recorder unknown. Saltburn in 1909; recorder unknown.

Phytosus spinifer Curtis. Unknown. There are three Yorkshire records: (VC61) Spurn in 1952; WOS. (VC62) Scarborough in 1899; JHB. Saltburn in 1902; MLT.

Arena tabida (Kiesenwetter). pRDBK. A species of coastal habitats. There is a single Yorkshire record: Spurn (VC61) in 1963; WOS.

Diglotta mersa (Haliday). Local. This species is found under stones on sand between the tides. The only Yorkshire records are from Spurn (VC61) in 1947; EWA and 1963; RCW.

Hygronoma dimidiata (Gravenhorst). Local. Generally in leaf litter and moss in rich marshland. Widely distributed in the county with records from all VCs but, rather surprisingly, there are no records from the eastern half of VC61. Last record: Hall Garth Ponds, Ripon (VC65) in 2002; RJM.

Cypha discoidea (Erichson). Notable B. Widely distributed in England (mainly southern). Confined to fens, marshes and estuaries where it is associated with plant litter. The two county records are both from VC61: Hornsea (presumably the Mere) on an unrecorded date; recorder unknown. Hornsea Mere in 1996; RJM.

Cypha hanseni (Palm). Unknown. There are two Yorkshire records: Duncombe Park (VC62) in 1980 and Studley (VC64) in 1989; both CJ.

Cypha laeviuscula (Mannerheim). Common. Widely distributed in the county with records from all VCs (only one from VC65). Last record: Hopewell Farm, Knaresborough (VC64) in 2000; MLD.

Cypha longicornis (Paykull). Common. Widely distributed and common in Yorkshire, with records from all VCs. Last record: Sandall Beat Wood (VC63) in 2002; RJM.

Cypha pulicaria (Erichson). Notable. Associated with bogs and marshes. There are five county records: (VC61) Dunnington Common in 1971; EWA. Aughton Ings in 1988; RJM (teste CJ). (VC62) Mulgrave Wood in 1934; HB. (VC63) Morton Wood in 1985; DM det. MLD. (VC64) Fountains Abbey in 1995; RJM det. CJ.

Cypha punctum (Motschulsky). Unknown. Usually found among moss, litter and decaying vegetation. There is a single Yorkshire record: Ashberry Pastures (VC62) in 1972; EWA.

Holobus (= ***Oligota***) ***apicata*** Erichson. Notable. Confined to England and south-east Scotland. Found in woodland and pasture-woodland where it is possibly a predator on *Cis* (Cissidae) larvae and mites. There are 13 Yorkshire records from ten localities: VC61 (2), VC62 (3), VC63 (2), VC64 (1) and VC65 (2). Last record: Sharow Mires, Ripon (VC65) in 2002; RJM.

Oligota inflata (Mannerheim). Unknown. Widely distributed in the county with records from all VCs with the exception of VC65. Last record: Cadeby Churchyard (VC63) in 2000; RJM.

Oligota parva Kraatz. Local. Associated with carrion. Widely distributed in the eastern half

of the county: VC61 (6 localities), VC62 (1), VC63 (5) and VC64 (1). Last record: Pollington Churchyard (VC63) in 2000; RJM.

Oligota picipes (Stephens). Unknown. Past confusion with nomenclature renders the records from Saltergate (VC62) in 1937 (HB), Spurn (VC61) in 1948 (WOS) and Gawthorpe (VC63) in 1948 (WOS) unreliable without voucher specimens. The only authentic records are from: (VC62) Staxton in 1996; LA det. MLD. Rawcliffe Meadows in 1997; MLD. (VC63) Stoney Royd in 1987; EJS (teste CJ).

Oligota pumilio Kiesenwetter. Local. Past confusion with *O. pusillima* (Gravenhorst) renders the records from Scarborough (VC62) on an unrecorded date (KL) and Malham (VC64) in 1957 (WOS) unreliable without voucher specimens. The only authentic county record is from Torne Bridge (VC63) in 1969; EWA.

Oligota punctulata Heer. Unknown. There are 32 Yorkshire records (all since the revision of the genus in *Ent. Monthly Mag.* **106**: 54-62) from 23 localities (mainly in the southern half of the county): VC61 (3), VC63 (13), VC64 (3) and VC65 (4). Last record: Willow Garth, Ripon (YWT reserve) (VC64) in 2002; RJM.

Oligota pusillima (Gravenhorst). Unknown. Past confusion with *O. pumilio* Kiesenwetter renders the records from Spurn (VC61) in the mid-20th century (WOS) and Dalton, Huddersfield (VC63) in 1948 (EWA) unreliable without voucher specimens. The only authentic records are from: VC61 (2), VC62 (1) and VC63 (4). Last record: Brook Farm, Elstronwick (VC61) in 2001; WRD det. MLD.

Unconfirmed, doubtful and erroneously recorded species

The following species have not been included on the Yorkshire list for the reasons discussed below.

Calodera uliginosa Erichson. Specimens collected at West Bretton (VC63) in 1948 were originally described as this species (*Naturalist* **74**: 151). The specimens are in the Manchester University Museum collection and have been re-identified as *C. riparia* Erichson (CJ *pers. comm.*). As there are no further county records the species is removed from the Yorkshire list.

Dexiogyia corticina (Erichson). The single record: Filey (VC61) in 1914 (ECH) is unreliable without a voucher specimen.

Meotica anglica Benick in Muona. Past confusion with other members of the genus renders the record from Scarborough (VC62) on an unrecorded date (RL) unreliable without a voucher specimen.

Schistoglossa aubei (Brisout). Specimens from Bubwith (VC61) in 1919, originally described as this species, have proved to be *Philhygra* (= *Atheta*) *melanocera* (Thomson) (*Naturalist* **125**: 72).

Alaobia* (= *Atheta*) *hybrida (Sharp). There are two records, both from VC62: Sleights on an unrecorded date and East Row in 1936 (both HB). Past confusion with other members of the genus renders these records unreliable without voucher specimens.

Microdota* (= *Atheta*) *inquinula (Gravenhorst). Past confusion with nomenclature renders the following record unreliable without a voucher specimen: Skelder (VC62) in 1936 (HB).

Alevonota rufotestacea (Kraatz). Past confusion with other members of the genus renders the following records unreliable without voucher specimens: (VC62) Saltburn Wood in 1905 (MLT). (VC64) Studley on an unrecorded date (EAW).

Aleochara lata Gravenhorst. The records of this species from Sandbeck Park (VC63) in 1981, Cat Babbleton (VC62) in 1985 and Rainsborough (VC63) in 1985, documented as new for Yorkshire (*Naturalist* **111**: 96), have proved to be *A. curtula* (Goeze). Although corrected (*Naturalist* **113**: 151), the earlier entry was, unfortunately, perpetuated (*Coleopterist* **6** (1): 36). As there are no further records the species is removed from the Yorkshire list.

Aleochara moesta Gravenhorst. Past confusion with nomenclature renders the following records unreliable without voucher specimens: (VC61) Holme on Spalding Moor in 1924

(TS). (VC62) Byland in 1892 (MLT). (VC63) Sunnydale, near Bradford in 1916 (JS). (VC64) Arnecliffe Wood in 1925 (MLT). Adel Dam in 1963 (JHF).

Gyrophaena congrua Erichson. Past confusion with other members of the genus renders the following records unreliable without voucher specimens: (VC62) Saltburn Wood in 1898 (recorder unknown). Fylingdales Moor on an unrecorded date (WJF). Buttercrambe in 1951 (AS). (VC63) West Bretton in 1948 (EWA).

Gyrophaena lucidula Erichson. Past confusion with other members of the genus renders the following records from VC62 unreliable without voucher specimens: Saltburn in 1896 and Scarborough on an unrecorded date (both recorder unknown).

Cypha seminulum (Erichson). There are two records, both from VC62: Saltburn in 1896 (MLT) and Cornelian Bay in 1926 (recorder unknown). Past confusion with nomenclature renders these records unreliable without voucher specimens.

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BOOK REVIEWS

Fungus Fred Goes Foraying. Fungi facts and fun for children 7-11 years by **Maggie Hadley.** Pp. 25, fully illustrated. British Mycological Society, Kew. 2002. £5.25 (incl. postage & packing) from The Librarian, British Mycological Society, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE.

How the Mushroom Got its Spots. An explainer's guide to fungi by Sue Assinder and **Gordon Rutter.** Pp. 44, fully illustrated. British Mycological Society/Biotechnology & Biological Sciences Research Council, Kew. 2002. Free upon request from The Librarian, British Mycological Society, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE or e-mail education@britmycolsoc.org.uk

In Maggie Hadley's book, Fred is a cuddly toy gnome who lives in the woods and notices hosts of fungi one day. So sensibly he goes to the library, where an extremely knowledgeable and friendly lady librarian gives him an introduction to the different types of fungi and of course warns him not to eat any as they may be poisonous. As a consequence, Fred becomes a fungus detective and eventually, at the weekend, goes with the librarian on a foray led by Dr Blewitt.

With the help of an attractive cover, excellent watercolour paintings (by Philippa Johnson), diagrams and photographs of specimens and forayers she covers collecting, classifying, English names and the binomial system, and written recording. At the end there is a record sheet to photocopy, instructions for making a spore print, a puzzle square and a short bibliography.

In spite of the book being written in "story book" style, the author does not talk down to her readers as she gives a real insight into the study of fungi. Although the book is for 7-11 years olds, the facts are suitable for older beginners, especially as cuddly toys have such appeal for young adults now.

How the Mushroom Got its Spots is written for teachers and local recording groups and is quite a learned volume masquerading under a rather naïve title. In spite of this, the covers have very attractive photographs showing specimens *in situ* and young workers in the field.

The lettering is overlaid on a faint picture of a fly agaric, as is present fashion, but I failed to notice the specimen at first!

The three sections of the booklet are (1) Introduction and basic information for field and classroom, and some biological information, together with a list of links to the National Curriculum; (2) 18 worksheets which can be photocopied for class handouts; (3) 8 appendices which include information about the BMS and BBSRC, fungi and the school curriculum; suppliers and contacts; bibliography; 8 web sites; the all important Health & Safety guidance; tips for running a foray; and a glossary.

The 18 worksheets should be extremely helpful for teachers, WATCH and other leaders as they contain much useful information, good diagrams and are well laid out. The simple experiments need little equipment and no microscope work is included. There is a recording sheet, 5 simple experiments, a simple key to types (not species), puzzles and brainteasers for end of term fun. The most colourful experiment, suitably called "How the mushroom got its spots", involves red balloons and tissues as basic ingredients. Make sure this is the last lesson of term – as a retired teacher I can see and hear the classroom chaos! JP

Living Landscapes: Parkland by **Graham Harvey.** Pp. 159, with 74 colour plates and 27 drawings, 25 in colour. Published by National Trust Enterprises Ltd., London. 2002. Price £16.99 hardback.

This beautifully produced book deals with parks in an evolutionary context from the mediaeval deer park to the latest manifestation, the theme park. However, it is believed that the basic design of all parks, open country with scattered clumps of trees and shrubs, derives from a human affinity with similar natural vegetation, forest pasture, so Chapter 1 deals with the earliest known examples of this type of vegetation, the royal forests. Forest law and the way in which this was administered in practice is discussed in some detail.

Harvey explains the circumstances whereby mediaeval deer parks which, in essence, came to be private living larders for all types of flesh, evolved into symbols of wealth. The more stable conditions of the Tudor period enabled the gentry to build unfortified houses within the park pale, thence to copy the continental model for large formal gardens around the house and ultimately, when resources became available, to subsume these into vast landscaped parklands whose prime purpose was to give pleasure. Eventually, as a consequence of industrialisation, municipal parks were created for the recreation of the people at large.

For the naturalist there is a chapter on the "wildlife riches" of parkland, emphasis being placed on those that require ancient pollards surrounded by pasture, and there is a final chapter on the efforts being made, especially by the National Trust, to preserve and sustain this type of habitat.

The text is accompanied by a wealth of illustrations ranging from superb photographs to paintings, lithographs and drawings. For those interested in country estates it is an excellent complement to Adrian Tinniswood's "Historic Houses of the National Trust". There is a brief description of six National Trust properties, all with extensive parks, and a list of books for "further reading". DJB

The Moths and Butterflies of Great Britain and Ireland. Volume 4 by **A. M. Emmet and J. R. Langmaid (Eds).** Part 1, Oecophoridae – Scythrididae (excluding Gelechiidae). Pp. 26, 7 col. pl.; Part 2, Gelechiidae. Pp. 277, 6 col. pl. Harley Books, Colchester. 2002. £82.50 (£44.00 each part separately), softback.

The publication of volume 4 of this monographic series, intended eventually to cover the whole of the British lepidoptera, has long been awaited, particularly as it deals with families for which there is otherwise little collected modern information in the British literature. The volume has been published simultaneously in two parts, the major family Oecophoridae together with other families containing relatively few British species as Part I while Part 2 treats the 160 British species in the family Gelechiidae.

The present volume is dedicated to the late A. Maitland Emmet, senior director of the series from 1987 until his death in 2001, and Part 1 opens with a tribute to him by the publisher, Basil Harley. Previous volumes have contained an introductory chapter on some related aspect of moth behaviour, and this practice is continued in the present volume with a 30-page contribution by J. Rydell and M. R. Young on *The ecology and evolution of lepidopteran defences against bats*. This series has shown continued improvement during the course of publication; a notable leap into the 21st century has been the decision to include genitalia illustrations for each of the species treated in the present volume. Previously they were included only if it was considered that such illustration was essential for a reliable determination.

Although the series has always been a multi-author work, the present volume, and particularly Part 2, has drawn on the expertise of numerous professional and amateur microlepidopterists, many being renowned authorities on the family, genus or group of species that they have treated. Careful editing has ensured a consistent and seamless treatment throughout. The systematic sections follow the format of previous volumes in the series: the present volume has keys to sub-families and species, including an illustrated key to the genera of the Gelechiidae based on male genitalia and with drawings of wing venation and other structural characters where appropriate. The species accounts cover synonomy, description of the imago, life history information and distribution, including a map showing vice-county distribution for all except adventive or doubtfully occuring species. The life history information in particular contains much that is new and previously unpublished while the distribution maps appear to be more up to date than some in previous volumes. Inevitably in a work of this complexity there are a number of errors and a revised sheet of Addenda and Corrigenda accompanies the volume (updating the Addenda and Corrigenda sheet which accompanied the hardback edition published earlier in the year); even so, it is not comprehensive. For many readers a major asset of this volume will be the superb colour illustrations by Richard Lewington (depicting 'half' moths) that cannot be praised too highly. The present volume in this continuing series, improving on its predecessors, is an absolutely indispensable purchase for anyone with an interest in the microlepidoptera, this softback edition representing exceptional value; the hardback edition is available at a cost of £150.00 (£80.00 each part separately). HEB

A Palaeoecological Study of Raised Mires in the Humberhead Levels by **Brian M. Smith.** Pp 153, with b/w illustrations. Thorne & Hatfield Moors Monograph No. 1. BAR British Series 336. 2002. £29.00 softback, from Hadrian Books, 122 Banbury Road, Oxford OX2 7BP.

This mongraph is based on a PhD thesis produced in 1985 but published now in a form accessible to a wider audience. The original doctoral research has been much cited over the years and has been updated in the current publication to include more recent work on the palaeoecology of mires. It contains much valuable data, including nine pollen diagrams from Thorne and Hatfield Moors, covering the period 4,500 to 500 BP. Topics covered include the history of drainage in the Humberhead levels, the structure and hydrology of raised mires, climate change and 'recurrence surfaces', human impact on vegetation, and a discussion of the historical basis for the classification of mires. Scientific techniques employed include studies of peat stratigraphy, pollen, rhizopods and plant macrofossils. Radiocarbon dating provides a firm chronology for the environmental reconstructions. There is an extensive and useful bibliography. Illustrations are clear and helpful but presented at the back of the monograph rather than interleaved with the text. This book will be essential reading for all those involved in the conservation of the Humberhead Levels or palaeoecological research in other areas, but the price and academic style will make it less attractive to the general reader.
MAA

A Passion for Natural History. The Life and Legacy of the 13th Earl of Derby edited by **Clemency Fisher.** Pp. 240, with 330 illustrations (mainly colour). National Museums & Galleries on Merseyside, Liverpool. 2002. £25.00 paperback.

Lord Stanley's (1775-1851) passion for natural history manifested itself in the form of a 100-acre zoological garden, with an animal collection which surpassed that of the Zoological Society in London, and an unparalleled collection of botanical and horticultural books, prints and drawings (including those of the mycologist James Bolton of Halifax).

He also purchased or commissioned natural history artwork to record the rare species in his collection, including that undertaken by Edward Lear, hence the title of the 2002 exhibition "The Earl & the Pussycat" which celebrates the 150th anniversary of the founding of the Liverpool Museum. His collections, which provided the foundation of the Museum, are lavishly portrayed in this volume, which is so much more than a catalogue in that it contains considerable supporting detail. Five sections of catalogue entries for 121 items, fully illustrated and described, are interspersed with 12 chapters on all aspects of the Earl's life, including his political and scientific achievements, his zoological and art collections and library at Knowsley, and his support and patronage of Edward Lear.

All-in-all this volume provides a fitting tribute to a remarkable man to whom we should be eternally grateful for amassing a unique private collection, bequeathed to the nation as a rich and valuable natural history resource. The editor, contributors and publisher are to be congratulated on both the content and production of this celebratory volume.

MRDS

Air Pollution Science for the 21st Century edited by **J. Austin, P. Brimblecome and W. Sturges.** Pp. ix + 676, including numerous line drawings and tables. Elsevier, Amsterdam. 2002. €140.00, hardback.

This multi-authored volume contains 23 chapters on many aspects and types of air pollution manifested over the past three decades. Topics of interest to the environmental and ecological scientist concerned with monitoring the environment include atmospheric chemistry (e.g. CO_2, S, N, NO_x, hydrocarbons, VOCs, aerosols, particulates, ozone and other secondary photochemical pollutants, acid rain), sustainability of air quality, climate change and the case for a "Law of the Atmosphere". Although rather technical, this authoritative work provides a valuable reference work for interpreting the nature of air pollution problems, their measurement, spread and limitation. Rather expensive, but a must for scientific libraries.

MRDS

A Catalogue of Alien Plants in Ireland by **Sylvia C. P. Reynolds.** Pp. 414. National Botanic Gardens, Glasnevin. 2002 €40.00 hardback, €25.00 paperback (incl. postage & packing from the National Botanic Gardens, Glasnevin, Dublin 9).

This compendium details records of c.920 alien plant species and hybrids on a vice-county basis. The impact these plants make on the environment is apparent when one compares the native Irish flora of 1140 ± 40 species and hybrids. Introductory sections review the history of recording, means of introduction, establishment and impact of alien plants. A summary shows that of the 370 taxa recorded in the 19th century, 50 have not been recorded since, and that the current list (1987-2001) contains 645 taxa of which 70% are of cultivated origin (compaed with 54% in the 19th century); about 200 taxa are considered to be established. The main body of the text contains a detailed breakdown of the vice-county records including useful information on habitats, published sources and herbaria. A comprehensive bibliography (50 pages) and index (Latin and English names) of taxa (including synonyms) are provided.

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The *Irish Naturalists' Journal,* sucessor to the *Irish Naturalist,* commenced publication in 1925. The quarterly issues publish papers on all aspects of Irish natural history, including botany, ecology, geography, geology and zoology. The *Journal* also publishes distribution records, principally for cetaceans, fish, insects and plants, together with short notes and book reviews.

Current subscription rates for four issues (including postage): €25.00 (£15.00 stg); Students €8.00 (£5.00 stg). Further details from: Mr Brian Nelson, INJ, Department of Zoology, Ulster Meseum, Botanic Gardens, Belfast BT9 5AB.

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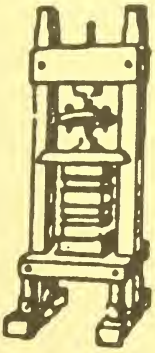

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October-December 2003

Number 1047
Volume 128

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The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Aquatic plants in the Pocklington and Driffield Canals with regard to the potential extension of navigation – *R. Goulder*

Are moth numbers declining? Evidence from moth trapping in Headingley (Leeds), West Yorkshire – *J. Bowers*

The spider fauna of Askham Bog, York, and the assessment of conservation value – *G. S. Oxford and A. G. Scott*

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AQUATIC PLANTS IN THE POCKLINGTON AND DRIFFIELD CANALS WITH REGARD TO THE POTENTIAL EXTENSION OF NAVIGATION

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Introduction

Canals in England were largely constructed during a time of expanding trade in the late 18th and early 19th centuries. Their prosperity was brief and under competition from railways and later roads there was widespread decline throughout the late 19th and early 20th centuries (Rolt, 1985). Those canals that survive as watercourses but on which navigation has ceased, or that carry light boat traffic, have become known for the richness of their aquatic flora and for their significant botanical conservation value (Briggs, 1996; Willby & Eaton, 1996). Some less common aquatic plants are characteristically associated with canals, such as species of submerged linear-leaved pondweeds, e.g. *Potamogeton compressus* and *P. friesii* (Preston, 1995); natant and emergent flowering plants, e.g. *Luronium natans* (Ferguson *et al.*, 1998) and *Butomus umbellatus* (Preston & Croft, 1997); and stoneworts, e.g. *Nitella mucronata* (Moore, 1986). In consequence, many lengths of canal are Sites of Special Scientific Interest (Briggs, 1996).

Botanically-valuable canals are, however, inherently unstable habitats, being unscoured watercourses, liable to silt up. Hydroseral succession tends to lead to uninteresting monoculture of emergent macrophytes and ultimately to terrestrialization. Furthermore, sections of disused canals have been lost through being filled in. In Yorkshire, for example, this includes lengths of the Dearne and Dove Canal, Market Weighton Canal and the Huddersfield Narrow Canal – this last, however, was re-excavated and re-opened to navigation in 2001.

The re-opening of the Huddersfield Narrow Canal is part of a recent canal revival, that in Yorkshire has also included the re-opening of parts of the Rochdale Canal and, to less intensive use, the Pocklington Canal. Canals are re-opened for amenity and leisure use and because of perceived local economic benefits but their restoration also has important conservation and educational value in that the historically significant industrial structures and artefacts that comprise the canal are preserved and restored. Canal restorations and the re-appearance of boats may, however, be viewed negatively from the perspective of biological conservation (Shirley, 1993; Lavelle, 2002). It is recognised, however, that a rich aquatic flora is compatible with light boat traffic (Preston, 1995; Briggs, 1996; Willby *et al.*, 2001); indeed its survival may in part depend on the management regime that is needed to maintain navigation and counter succession and terrestrialization. Heavy boat traffic, in contrast, is incompatible with abundant and diverse vegetation because it causes direct physical damage to plants and, through increase in turbidity, hinders underwater light penetration and photosynthesis (Murphy & Eaton, 1983). Such a situation was exemplified by the restored Rochdale Canal at Hebden Bridge where, in July 2000, there was constant traffic of narrow boats and other craft, extremely turbid water, and a paucity of aquatic vegetation that was limited to a fringe of *Glyceria maxima*, an odd marginal clump of *Iris pseudacorus*, and a very few floating plantlets of *Lemna minor*.

This study reports on the vegetation of the Pocklington Canal and the Driffield Canal within vice-county 61, which approximately corresponds to administrative East Yorkshire. The canals form part of, or are associated with, SSSIs that are designated because of the conservation value of their aquatic vegetation, although both may be partially degraded by enrichment brought about by the discharge of phosphate-rich, treated sewage effluent. The work was undertaken because both waterways are potentially liable to see an increase in their navigable length. Information on plants in canal-feeder streams and adjacent

watercourses was also collected in order to show whether aquatic plant species in the canals reflected those in adjacent watercourses or formed a distinct species assemblage.

Pocklington Canal

The Pocklington Canal (Fig. 1) runs for about 14.8 km from Canal Head (GR: SE 800 473) to East Cottingwith where it joins the Yorkshire River Derwent at Cottingwith Lock (SE 701 427). It is a wide-boat canal with locks that will admit craft of about 4.3 m in width. The canal was built between 1815 and 1818 and suffered a long decline from about 1850 until commercial navigation ceased in 1932 when it fell into dereliction (Duckham, 1973).

Cottingwith Lock was repaired in 1971, and by 1987 navigation by pleasure craft had been restored along about 8.3 km of canal from the River Derwent to Thornton Lock at Melbourne, although the effective head of navigation is the Melbourne Arm, 0.75 km short of Thornton Lock. Since then there has been further restoration of locks, but navigation beyond Melbourne has not been resumed (Anon., 1993). Boat traffic on the restored section is very light: counts through Barmby Lock, where the River Derwent Navigation joins the tidal River Ouse, were only 79 in 2000 and 62 in 2001, having decreased from 327 in 1990 and 340 in 1991, and most of these craft probably did not leave the Derwent.

The canal water has near-neutral pH and high conductivity. At six sites between Canal Head and No. 1 Swingbridge at Storwood the pH range in July-August 2002 was 7.2-7.8 and the conductivity was 538-731 $\mu S\ cm^{-1}$. Water is fed into the canal from Pocklington Beck, at Canal Head and at Thornton Lock. The Beck receives treated effluent from Pocklington sewage works between Canal Head and the second feeder. The length of canal that is navigable downstream of Thornton Lock is, therefore, potentially richer in inorganic nutrients. Thus, Environment Agency data gave a mean orthophosphate concentration, from 12 samples taken between January and November 2002, of 61 (range <20-82) $\mu g\ PO_4\text{-}P\ l^{-1}$ at Canal Head, compared to 358 (<20-979) $\mu g\ l^{-1}$ at Church Bridge and 128 (<20-405) $\mu g\ l^{-1}$ at Hagg Bridge, respectively 0.25 km and 4.8 km downstream of the feeder at Thornton Lock. Nitrate-N concentration, in contrast, was high throughout the canal – i.e. 10.8 (7.6-12.7) $mg\ l^{-1}$ at Canal Head, 8.3 (5.3-11.4) $mg\ l^{-1}$ at Church Bridge, and 5.9 (0.6-11.0) $mg\ l^{-1}$ at Hagg Bridge - presumably because of the high concentration in Pocklington Beck derived from fertilisation of its catchment.

Aquatic plants in the canal were recorded in July-August 2002 along twelve 500 m lengths, designated Pa-Pl. Six of these (Pa-Pf) were on the non-restored part of the canal, while six (Pg-Pl) were on the navigable part (Fig. 1). Holmes (1994) recommended 500 m as the minimum length of river appropriate for adequate assessment of plant species richness. Plants along each 500 m length were recorded visually, aided by clear water, and by between 28 and 47 grapnel hauls. A checklist was used of aquatic plants that occur in England and Wales (Palmer & Newbold, 1983); also included were all *Juncus* species, the aquatic moss *Fontinalis antipyretica,* and charophytes which were recorded as a single category. Nomenclature follows Stace (1997) for vascular plants and Moore (1986) for charophytes. An abundance score was given to each taxon, i.e. 1 = <0.1% cover, 2 = 0.1-5% cover, 3 = >5% cover (Holmes, 1983).

Much the most abundant emergent plant was *Glyceria maxima*. In the non-navigated lengths there was complete cover by this plant over Length Pa downstream of Top Lock (Fig. 1), and over much of Length Pb, being rooted at the margins and forming a floating mat in mid-channel. Such choking of disused canals is typical of *G. maxima* (Grime *et al.*, 1990). Most of Length Pf had 100% cover of emergent plants comprised of both *G. maxima* and *Phragmites australis*. An important emergent plant in other non-navigated lengths, *P. australis* occupied the whole width of the canal over about 250 m of Length Pd and dominated the marginal vegetation in much of Lengths Pc and Pe. In contrast to the rest of the non-navigated canal, Length Pa, upstream of Top Lock, had little emergent vegetation. This was because of dredging in November 2001. The surveyed lengths of navigable canal, Pg-Pl, all had complete or substantial marginal fringes of *G. maxima*, usually 1-3 m wide.

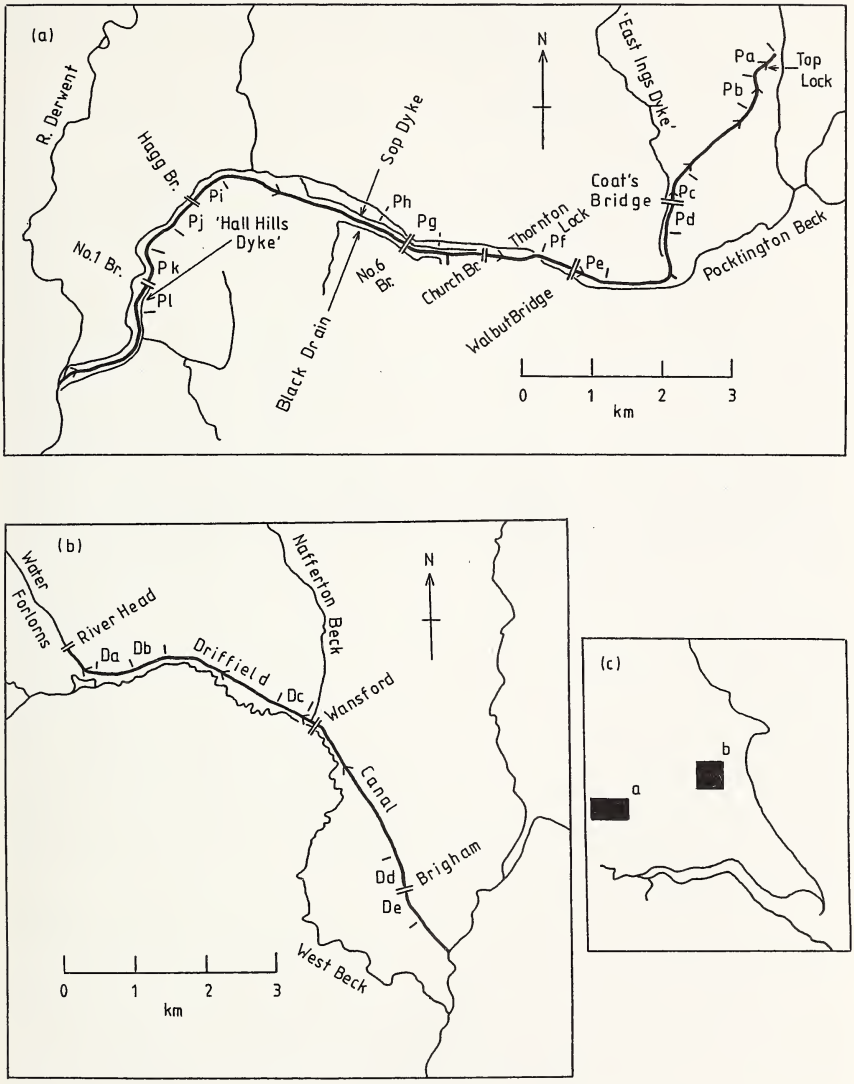

FIGURE 1.
(a) Map of the Pocklington Canal, and (b) the Driffield Canal; the 500 m lengths along which plants were recorded, Pa-Pl and Da-De, are shown. (c) The location of these two canals in East Yorkshire.

Floating-leaved macrophytes, *Nuphar lutea* and *Potamogeton natans*, were conspicuous in the non-navigated Length Pe. *N. lutea* was also abundant in the navigable Lengths Pi-Pl. The floating fronds of duckweeds, *Lemna minor* and *L. trisulca,* were also abundant along much of the canal. Conspicuous amongst these at some sites (Lengths Pc, Pg, Ph, Pj) were floating masses of filamentous chlorophycean algae and, sometimes, also *Enteromorpha* and/or *Hydrodictyon* (Ph, Pj).

The most important submerged plant in the non-navigated canal was *Elodea canadensis,* which in navigable lengths was replaced by *Elodea nuttallii*; this was enormously abundant and often much entangled with *L. trisulca* and, in some lengths (Pg-Pj), also with filamentous chlorophycean algae. Other notably conspicuous submerged macrophytes in the navigable canal were *Potamogeton lucens* in Length Pi, and *Ceratophyllum demersum* in Length Pl, a species of inorganically-enriched lowland waters (Goulder & Boatman, 1971). Charophytes were abundant in the non-navigable Length Pd and in the navigable Lengths Pi and Pj.

The total number of aquatic plant taxa per 500 m length fluctuated substantially in both the non-restored and the navigable canal (Fig. 2). The range was 10 to 24 in the non-navigable lengths and 12 to 27 in the navigable lengths, but the means of 16.0 taxa for the former and 16.7 taxa for the latter were not significantly different ($P>0.05$; Mann-Whitney *U*-test). For emergent plants alone there was also a substantial fluctuation in number of taxa per 500 m length (Fig. 2), ranging from 5 to 16 in the non-navigated section and from 3 to 17 in the navigated section, but the mean (9.7) for the former was again not significantly different from the mean (8.2) for the latter ($P>0.05$). In contrast, when the submerged and floating-leaved macrophytes were considered as a group (Fig. 2), there was less between-length variation in the number of taxa (range 5-8 in non-navigated lengths and 6-10 in navigated lengths), and the mean numbers were significantly different ($P = 0.05$), being 6.3 and 8.5 respectively.

An interesting observation was that the 500 m length with most taxa (27) and with most emergent species (17) was on the navigable canal. This was Length Pl, the farthest downstream length that was recorded. This high species richness appeared to be caused by cattle grazing low-lying pasture adjacent to the canal. The cattle ate the marginal *Glyceria maxima* for as far out as they could reach, leaving a poached, muddy strip on the landward side of the *G. maxima* that was ideal for colonisation by a diversity of emergent plants. Such disturbance by cattle encourages plants that prefer muddy places (Chatters, 1996). Here, *Agrostis stolonifera, Alisma plantago-aquatica, Apium nodiflorum, Caltha palustris, Eleocharis palustris, Equisetum palustre, Galium palustre, Juncus inflexus, Myosotis scorpioides, Ranunculus sceleratus, Rorippa nasturtium-aquaticum* and *Veronica beccabunga* were recorded in the poached muddy strip; also frequent and flowering conspicuously, but not on the checklist used, was *Bidens tripartita*, an uncommon plant in East Yorkshire (Crackles, 1990).

In the absence of cattle, trampling by anglers can facilitate colonisation by marginal aquatic plants (Goulder, 2001). Along the Pocklington Canal such trampling was observed to have encouraged *Mentha aquatica* in Length Pc and *Apium nodiflorum* in Length Pg.

The abundance data for the individual taxa along the Pocklington Canal (Fig. 3) emphasize the greater importance of submerged and floating-leaved plants in the navigable lengths; also emphasized is the inverse relationship between the 19th century colonist *Elodea canadensis* and the more-recent (1966) UK arrival, *E. nuttallii*. In this competition, *E. nuttallii* may be favoured by more nutrient-rich conditions (Preston & Croft, 1997).

The overall number of aquatic plant taxa recorded in the unrestored canal (37; comprising 14 submerged and floating-leaved taxa and 23 emergent taxa) was much the same as found in the navigable section (33; 11 and 22 respectively). Seven species of submerged and floating-leaved plants were found only in the unrestored section (*Callitriche* sp., *Fontinalis antipyretica, Potamogeton berchtoldii, P. crispus, P. natans, Ranunculus circinatus, Sparganium emersum*), while four species were found only in the navigable section (*Ceratophyllum demersum, Lemna gibba, Potamogeton friesii, P.*

lucens). Six emergent species were recorded only from the unrestored canal (*Berula erecta, Butomus umbellatus, Carex acutiformis, Juncus articulatus, J. effusus, Mentha aquatica*), while five species were found only in the navigable section (*Apium nodiflorum, Caltha palustris, Eleocharis palustris, Equisetum palustre, Sagittaria sagittifolia*).

None of the vascular aquatic plants found (Fig. 3) are scarce in Britain, in that none are recorded nationally in fewer than 100 ten-km squares (Preston & Croft, 1997), but some are considered to be in need of special protection in at least the east of the former Yorkshire

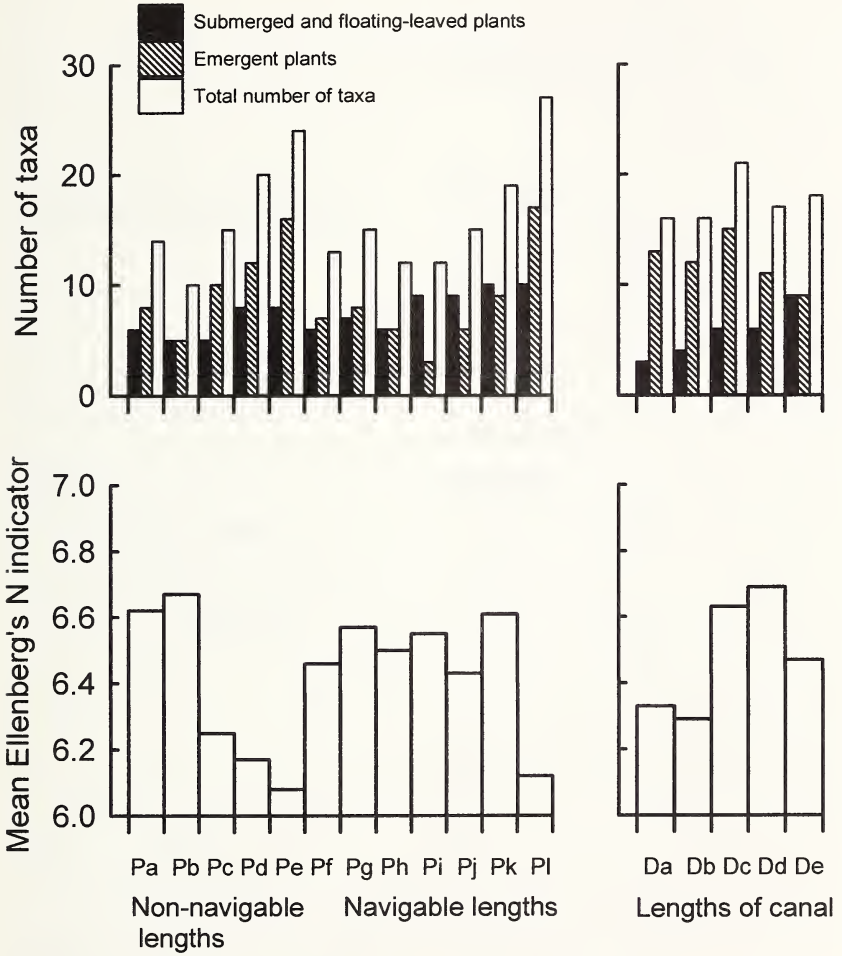

FIGURE 2.

(Top) the number of submerged and floating leaved taxa, the number of emergent taxa, and the total number of aquatic macrophyte taxa in 500 m lengths of (left) the Pocklington Canal, and (right) the Driffield Canal. (Bottom) The mean Ellenberg's nitrogen indicator values for aquatic macrophytes in 500 m lengths of (left) the Pocklington Canal and (right) the Driffield Canal.

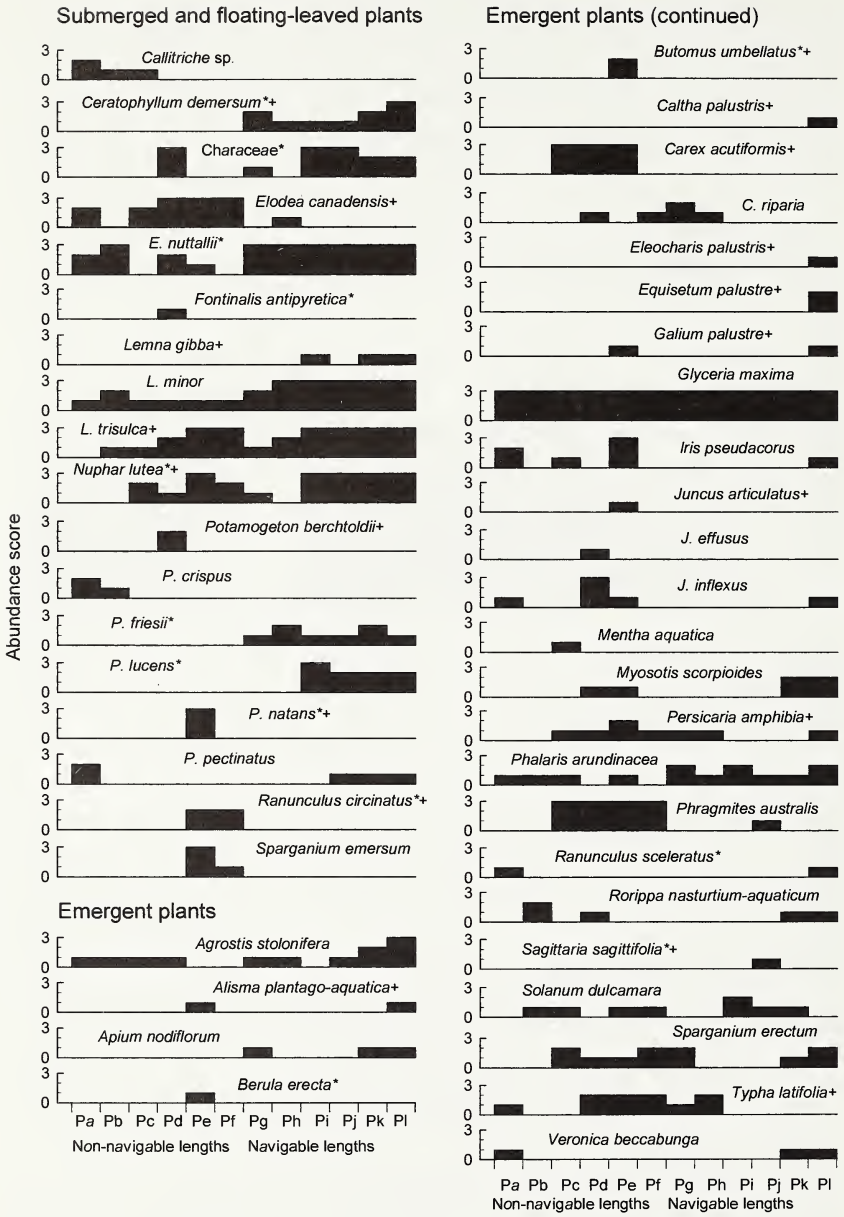

FIGURE 3.
Abundance scores for aquatic macrophyte taxa in 500 m lengths of the Pocklington Canal, July-August 2002. *Indicates taxa that were not also recorded in adjacent watercourses. +Indicates taxa that were not also found in the Driffield Canal.

Water Authority area by Palmer and Newbold (1983) and/or were described as uncommon or infrequent in East Yorkshire by Crackles (1990); these are *Ceratophyllum demersum, Lemna gibba, L. trisulca, Potamogeton berchtoldii, P. friesii, Ranunculus circinatus* and *Butomus umbellatus*. More recent observations suggest, however, that several of these species may have been under-recorded since they are to be found at a variety of dyke and pond sites in East Yorkshire (Goulder, 2000; Linton & Goulder, 2000). Those with a genuinely limited distribution are probably: *L. gibba*, recorded post-1970 in only four 10-km squares in vice-county 61 (Preston *et al.*, 2002), although long found in the Pocklington Canal where, for example, it was described by Crackles (1968) as completely covering the water as far as the eye could see at Melbourne in July 1968; *P. friesii*, recorded post-1970 in five 10-km squares in VC 61 (Preston *et al.*, 2002), was probably local in Britain until it spread along the canal network, where it persists unless excluded by terrestrialization or too heavy boat traffic (Preston & Croft, 1997); *B. umbellatus*, another species that has spread along canals (Preston & Croft, 1997), more frequent in VC 61, being recorded post-1970 in thirteen 10-km squares (Preston *et al.*, 2002), and currently, apparently, extending its range in northern Britain (Preston & Croft, 1998).

The mean Ellenberg's nitrogen indicator value was calculated for the aquatic vascular plants that were recorded in each 500 m length. Ellenberg's indicator values are allocated to vascular plant species and reflect preference for a range of environmental features, i.e. light, moisture, pH, nitrogen, salinity (Hill *et al.*, 1999). Their N indicator values as modified for Britain were used; these may be regarded as a general indicator of a plant's preferred soil fertility rather than being specific to nitrogen regime. The range is 1-9, with low values indicating preference for low fertility. The sum of the N indicator values for those species recorded in each 500 m length was divided by the number of species. There was no clear distinction between the mean values for the non-navigable lengths and the navigable, and phosphate-enriched, lengths (Fig. 2). Relatively high mean values were found in the non-navigated Lengths Pa, Pb and Pf as well as in the navigable (and enriched) Pg-Pk. Conversely, relatively low values were found in the navigable Length Pl as well as in the non-navigable Pc-Pe. Overall, the mean N indicator values were not significantly greater in the navigable lengths ($P>0.05$, Mann-Whitney U-test), but there was an inverse correlation between the mean N indicator value and the total number of aquatic plant taxa (Spearman's rank correlation coefficient $r_s = -0.67$, $P<0.05$).

The lack of an obvious increase in mean Ellenberg's N indicator values in response to phosphate enrichment suggested that absolute concentrations of inorganic nutrients were sufficiently high at all sites, because of background inputs, for the distribution of vascular aquatic plants not to be limited by shortage of inorganic nutrients. Both upstream and downstream of the feeder at Thornton Lock the PO_4–P and NO_3–N concentrations were within ranges that are conventionally associated with eutrophic or hypertrophic fresh waters (Forsberg & Ryding, 1980). The association of lower mean Ellenberg's N indicator values with high species richness possibly suggests that high species richness, including some plants with a relatively low Ellenberg's N indicator value, was maintained in some lengths, in the face of competition from vigorous species with high nutrient demand, because of distinctive physical features or management practices; for example, Length Pe had deep water behind Walbut Lock that favoured *Potamogeton natans* (N indicator value 4), and Length Pl had cattle-poached margins that supported *Caltha palustris* (N indicator value 4), *Eleocharis palustris* (4), *Equisetum palustre* (3) and *Galium palustre* (4).

Although the Characeae are shown as a single category in Figure 3, representative stoneworts were identified by P. J. Cook and A. Henderson. *Chara vulgaris* agg., abundant in the non-navigable length Pd, is widely distributed in lowland Britain (Moore, 1986). Those found in the navigable canal were *Nitella* spp. and were more interesting; material confirmed as *N. mucronata* var. *gracillima* came from Lengths Pg and Pj. Moore (1986) has no records for *N. mucronata* north of the Severn-Wash line, although this may be the third Yorkshire record, the second for VC 61 (P. J. Cook, *pers. comm.*). Further material, from Lengths Pi and Pk, was identified as *N. translucens*. Moore (1986) has no post-1960

records for this species in north-east England. The 1900 record from a pond on Skipwith Common (Robinson, 1902) is apparently the sole previous East Yorkshire record (P. J. Cook, *pers. comm.*).

Driffield Canal

The Driffield Canal (Fig. 1) extends from River Head at Driffield (GR: TA 028 573) for about 8.0 km to its junction with Frodingham Beck, a tributary of the River Hull, at TA 083 528. It is a wide-boat canal built between 1767 and 1770. Income from the navigation suffered because of railway competition after 1846 and trading to Driffield had ceased by the 1950s (Duckham, 1973). About that time, the swing bridge at Brigham, about 1.1 km upstream of the junction with Frodingham Beck, was fixed and the canal beyond the bridge became inaccessible to boats. There was some piecemeal restoration of locks in the 1990s. Brigham Bridge was replaced with a new swing bridge in summer 2002, and was reopened to boat traffic in April 2003, potentially allowing navigation along a further 2.7 km to a fixed bridge at Wansford. In summer 2002 there were several small sailing boats moored downstream of Brigham Bridge and this section of canal was apparently in use for sail-boat racing on summer Sundays; there may also have been an occasional trip boat from the River Hull navigating the canal as far as Brigham. Upstream of Brigham Bridge there appeared to be occasional use by rowing boats.

The canal is fed at River Head by the Water Forlorns, an intermittent calcareous, spring-fed stream, and at Wansford by Nafferton Beck. The canal also receives the effluent from Driffield sewage treatment works, immediately downstream of Town Lock, at about 0.6 km downstream of River Head. This leads to enrichment, exemplified by increased phosphate concentration, increased algal (*Selenastrum*)-growth potential, more abundant bacterio-plankton, and greater colonisation of submerged plants by epiphytic bacteria (Kang & Goulder, 1996, 1997). The canal also receives fish-farm effluent at about 2.6 km downstream of River Head but the effects of this may be masked by the greater impact of the sewage-works effluent (Carr & Goulder, 1990a, 1990b).

The ranges of pH (7.3-8.1) and conductivity (547-568 $\mu S\ cm^{-1}$), from three samples taken between the sewage treatment works outfall and Brigham Bridge in June 2002, were broadly similar to values in the Pocklington Canal. In the Driffield Canal, as in the Pocklington Canal, phosphate concentration increased downstream of the source of sewage works effluent whereas nitrate concentration was high at all sites reflecting generally high nitrate levels in the feeder streams. Thus data from the Environment Agency, for January to November 2002, showed that the mean orthophosphate concentration was 34 (range <20-70) $\mu g\ PO_4\text{–}P\ l^{-1}$ at River Head (12 samples), compared to 458 (123-830) $\mu g\ PO_4\text{–}P\ l^{-1}$ at Whinhill Lock, 2.0 km downstream of the outfall (8 samples), and 273 (140-407) $\mu g\ l^{-1}$ at Wansford, 4.2 km downstream of the outfall (24 samples). Means and ranges for nitrate concentration, also from January-November 2002, were 9.4 (8.5-9.9) mg $NO_3\text{–}N\ l^{-1}$ at River Head (12 samples), 7.2 (5.7-8.8) mg l^{-1} at Whinhill Lock (11 samples), and 7.9 (6.5-9.2) mg l^{-1} at Wansford (24 samples).

Aquatic plants were recorded in June-September 2002 along five 500 m lengths of canal, designated Da-De (Fig. 1). All these lengths were downstream of the sewage treatment works outfall; Da extended downstream from 50 m below the outfall, while De extended downstream from Brigham Bridge and hence was on the short navigable section of canal. The recording procedure was the same as in the Pocklington Canal, and was facilitated by clear water; 21-30 grapnel hauls were made per 500 m length.

Marginal stands of emergent macrophytes were conspicuous along all the lengths surveyed. Exceptions were over about 100-200 m of Length Dd where emergent vegetation was excluded by dense tree shading and elsewhere where short stretches were devoid of marginal aquatic vegetation because of shading by hawthorn scrub or because of heavy grazing. *Glyceria maxima* was the dominant marginal plant. Exceptions were a substantial stand of *Phragmites australis* along about 100 m of the north side of Length Db, and abundant *Phalaris arundinacea* in Length De. Grazing by cattle along the south side of

Lengths Da-Dc had in many places resulted in a poached strip on the landward side of the *Glyceria* margin that encouraged the growth of a diversity of plants that thrive in muddy places; e.g. *Apium nodiflorum, Juncus effusus, J. inflexus, Mentha aquatica, Myosotis scorpioides, Rorippa nasturtium-aquaticum* and *Veronica beccabunga* in Length Da, and *Juncus bufonius, M. scorpioides, Ranunculus sceleratus* and *R. nasturtium-aquaticum* in Length Dc.

All lengths surveyed had abundant filamentous chlorophycean algae that covered the bed of the canal, and the surface in places, and entangled submerged vascular plants. There was also floating *Enteromorpha* in Lengths Dc-De. Submerged and floating-leaved plants were inconspicuous in Length Da, and were not luxuriant in Length Db. Indeed, in Length Da they were restricted to odd patches of *Callitriche* sp., sparse, grossly algal-entangled, *Elodea nuttallii* and occasional *Lemna minor*. This dearth of submerged plants may have been due to competition favouring filamentous algae in the highly enriched conditions close to the sewage works outfall. It is also possible that the effluent was locally toxic (Haslam, 1978). Furthermore, the canal bed here may have been an inhospitable rooting medium. Water depth was only about 0.5 m, overlying a thick layer of foul-smelling black silt that had probably originated from the sewage works outfall. Submerged species increased in abundance further downstream so that by Lengths Dc and Dd the open central channel had a more or less complete cover of, largely, *Callitriche* sp., *E. nuttallii* and *Potamogeton pectinatus*. These three taxa remained important in the most downstream, and navigable, Length De where they were accompanied by abundant *Potamogeton crispus* and the floating-leaved *Sparganium emersum*.

Neither the total number of aquatic plant taxa per 500 m length (range 16-21) nor the number of emergent taxa (9-15) showed any obvious trend along the Driffield Canal (Fig. 2). The number of submerged and floating-leaved taxa, however, increased from three species in Length Da, closely downstream of the sewage-works outfall, to nine in the navigable Length De.

The abundance data for individual taxa along the Driffield Canal (Fig. 4) emphasise that whereas the emergent plant community was of broadly equal importance along the whole canal, the submerged and floating-leaved community was greater in both abundance and species richness in the more downstream lengths.

The only aquatic vascular plant with obviously limited distribution in East Yorkshire that was recorded in the Driffield Canal was *Potamogeton friesii* a few plants of which were found in Length De. A further find, in one grapnel haul from Length Db, was the stonewort *Nitella mucronata* var. *gracillima*; this September record, following those of August from the Pocklington Canal, represented the third VC 61 record for this taxon.

The mean Ellenberg's N indicator values for vascular aquatic plants in 500 m lengths of the Driffield Canal were similar to those found for the Pocklington Canal (Fig. 2). There was no decrease with distance downstream of the sewage-treatment works outfall, possibly because absolute concentrations of inorganic nutrients were high at all sites. Indeed, relatively low mean N indicator values were recorded for Lengths Da and Db. This may have been because close to the outfall there was a confounding effect of toxicity and/or competition from filamentous algae upon species richness and community composition of the vascular plants.

Comparison between vegetation in the two canals

There were obvious similarities between the aquatic vegetation in the two canals. The emergent vegetation in both was dominated by *Glyceria maxima*, and species of *Elodea* were important components of the submerged vegetation, although whereas *E. canadensis* and *E. nuttallii* appeared to be competitors in the Pocklington Canal, only *E. nuttallii* was recorded in the Driffield Canal. Furthermore the submerged vegetation in both canals was often much entangled by filamentous chlorophycean algae, possibly because both watercourses were phosphate-enriched.

Conspicuous differences between the two canals resulted from the fact that in parts of

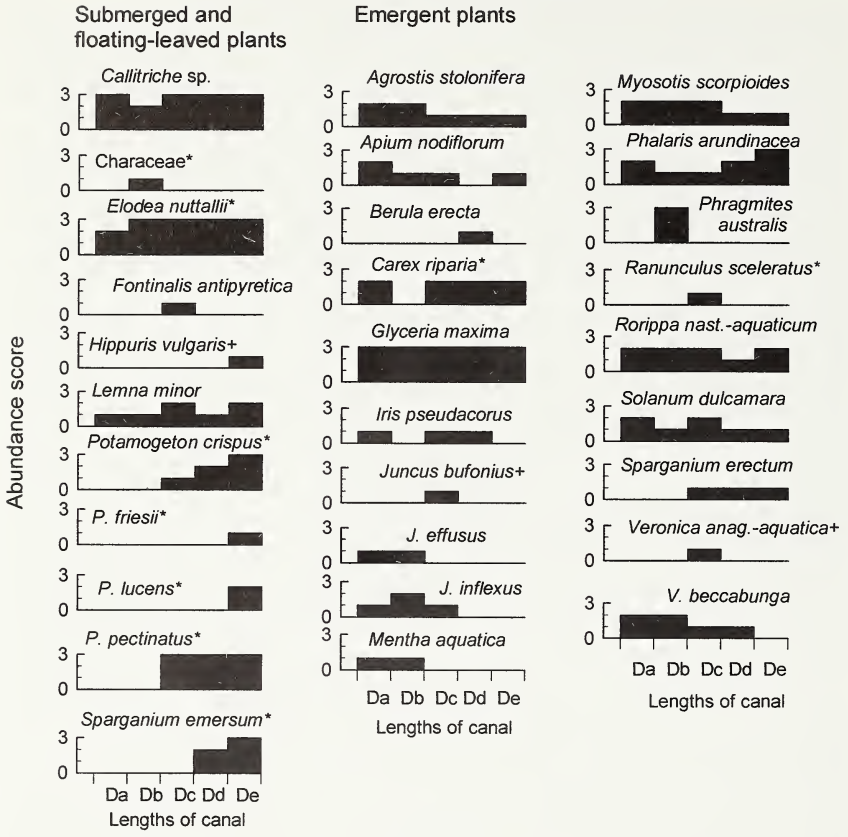

FIGURE 4.
Abundance scores for aquatic macrophyte taxa in 500 m lengths of the Driffield Canal, June-September 2002. *Indicates taxa that were not also recorded in adjacent watercourses. +Indicates taxa that were not also found in the Pocklington Canal.

the non-navigable section of the Pocklington Canal hydroseral succession had been allowed to proceed to the extent that the entire width of the channel was occupied by emergent vegetation (parts of Lengths Pa, Pb, Pd and Pf). This was detrimental to the submerged flora. In parts of the Driffield Canal, in contrast, submerged plants appeared to be repressed by direct and/or indirect impacts of the discharge of sewage works effluent (Lengths Da and Db). Another obvious difference was the absence of *Lemna trisulca* from the Driffield Canal, a plant that was conspicuous in much of the Pocklington Canal.

The vegetation of the Pocklington Canal was more species rich than the Driffield Canal, although this might be because the total length of canal surveyed was greater. In the Pocklington Canal 46 taxa were recorded of which 18 were submerged or floating-leaved and 28 were emergent species (Fig. 3). This compares with the Driffield Canal from which only 30 aquatic plant taxa were recorded, comprising 11 submerged or floating-leaved and 19 emergent species (Fig. 4). Nineteen of the taxa recorded from the Pocklington Canal

were not found in the Driffield Canal (Fig. 3). Only three of the Driffield Canal species were not recorded in the Pocklington Canal (Fig. 4).

Comparison of all seventeen 500 m lengths of canal that were surveyed, on the basis of species occurrence and abundance as shown in Figures 3 and 4, was made using detrended correspondence analysis (DECORANA) (Kent & Coker, 1994). The output of this analysis (Fig. 5) grouped lengths of canal according to the similarity of their vegetation – those that are closer to each other have more similar vegetation. The ellipses are drawn to help interpretation. DECORANA showed that the six 500 m lengths from the navigable, and enriched, Pocklington Canal (Pg-Pl) formed a distinct group. Similarly four of the non-navigable lengths of the Pocklington Canal (Pc-Pf) made up another distinct and well separated group of sites. The two most-upstream lengths of the Pocklington Canal (Pa and Pb) were, however, anomalous. They were well-distanced from the rest of the non-navigable lengths and were not especially similar to each other. Their anomalous status may be related to the effects of recent dredging in Length Pa and to terrestrialization of Length Pb. The Driffield Canal sites were separated from the Pocklington Canal sites. The two most upstream lengths (Da and Db) formed a distinct group, possibly reflecting their closeness to the sewage treatment works outfall and their relative dearth of submerged vegetation. The other three lengths of the Driffield Canal (Dc-De) were tightly grouped and were some distance from the two, more-upstream, lengths. It was notable that all the Driffield Canal lengths were closer to the six navigable lengths of the Pocklington Canal (Pg-Pl) than they were to the major cluster of non-navigable lengths of Pocklington Canal (Pc-Pf). This may be because the Driffield Canal and the navigable section of the Pocklington Canal both consistently have an open-water central channel and/or because both are enriched by sewage treatment works effluent.

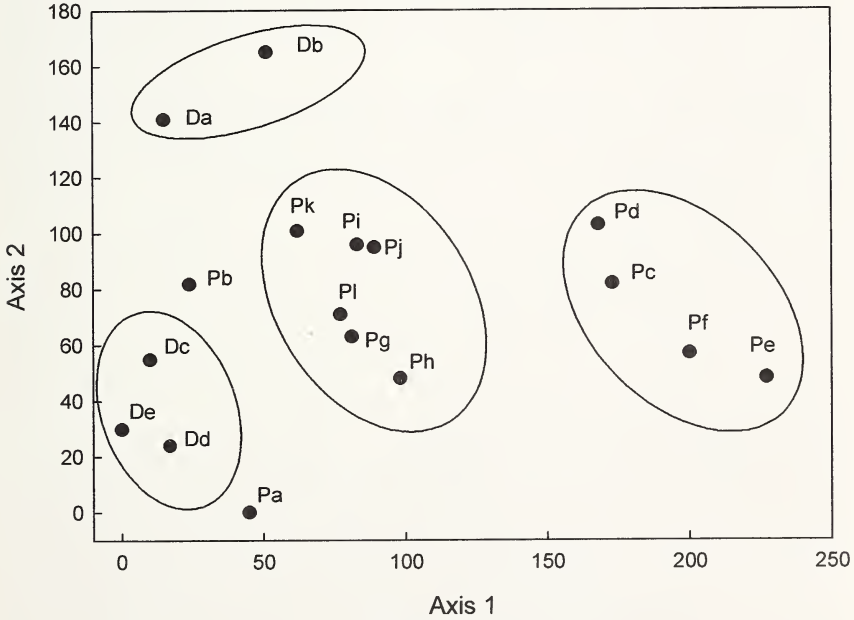

FIGURE 5.

Grouping of 500 m lengths of canal, on the basis of similarity of their vegetation, using DECORANA. Pa-Pf are unrestored lengths and Pg-Pl are navigable lengths along the Pocklington Canal; Da-De are along the Driffield Canal.

Comparison between aquatic plants in the canals and in feeder streams and adjacent watercourses

The species of aquatic plants that grow in a canal may be characteristic of the distinctive canal habitat, or they may simply have colonised from feeder streams and adjacent watercourses and hence will reflect the species composition of aquatic vegetation in the neighbourhood, or they may be a mixture of the two. The presence of plants that are characteristic of canals, and possibly otherwise of limited distribution in the neighbourhood, is potentially likely to lead to greater botanical conservation interest.

Aquatic plants were recorded in the feeder stream (Pocklington Beck) and dykes alongside the Pocklington Canal ("East Ings Dyke", Sop Dyke, Black Drain, "Hall Hills Dyke") (Fig. 1) in August 2002. A grapnel was used when appropriate and the extent of these watercourses that was surveyed is given in Table 1. Similarly, aquatic plants in the Driffield Canal feeders (Water Forlorns, Nafferton Beck) and West Beck, which flows alongside much of the canal (Fig. 1), were recorded during September-October 2002. The extent surveyed is given in Table 2.

Forty aquatic plant taxa were recorded from watercourses close to the Pocklington Canal (Table 1), whereas 46 were found in the canal (Fig. 3). Moreover, 13 of the canal taxa (Fig. 3) were specific to the canal, not being found in adjacent watercourses. It was the submerged and floating-leaved species that were most likely to be restricted to the canal. Indeed, nine out of 18 of the species with these growth forms, including three species of *Potamogeton*, were not found in adjacent watercourses. In contrast, only four out of 28 emergent species were found only in the canal. Plants that are noted above as having limited distribution and significant conservation value in East Yorkshire, and that were found only in the canal, were *Potamogeton friesii*, *Butomus umbellatus* and *Nitella* spp. Furthermore, *Lemna gibba*, also a plant with limited distribution in East Yorkshire, was probably found in "Hall Hills Dyke" (Table 1) only because it had been washed out of the canal a few days earlier when the canal overtopped its banks during a time of exceptionally high water level.

Thirty aquatic plant taxa were found in watercourses close to the Driffield Canal (Table 2). This equalled the number of taxa recorded from the canal (Fig. 4) but they were not the same 30 taxa. There were nine taxa that were recorded in the canal but not in adjacent watercourses (Fig. 4). Again, it was the submerged and floating-leaved plants, seven out of eleven taxa, including four species of *Potamogeton*, that were most likely to be found only in the canal. This group included *Potamogeton freisii* and *Nitella mucronata* var. *gracillima* which have a limited distribution in East Yorkshire.

Evidently, both canals provide an appropriate habitat for a range of aquatic plants, especially submerged and floating-leaved taxa, that are otherwise not to be found in other watercourses in their immediate neighbourhood, and some of these plants have at least local conservation value. This pattern of plant distribution may reflect the vegetational history of East Yorkshire in that species that were once widespread have been able to retreat to the canals. Alternatively, the canals may support their own distinctive flora because they are distinctive habitats, being slow-flowing, relatively-deep, clear-water, nutrient-rich, largely-unshaded watercourses.

Conversely, some aquatic plant taxa were found in neighbouring watercourses but not in the canals. Seven species in this category were recorded in waters adjacent to the Pocklington Canal (Table 1). Of these, the taxa with the most conservation interest were *Myosoton aquaticum* and *Rumex hydrolapathum*, both of which, according to Crackles (1990), have a limited distribution in East Yorkshire. Nine species that were not found in the Driffield Canal were recorded from its neighbouring watercourses (Table 2). Of these, only *Ranunculus penicillatus* is of specific conservation interest. In East Yorkshire it is restricted to the upper River Hull system (Crackles, 1990), and it was sparse in West Beck in summer 2002. The adjacent watercourses are often very different from the canals and provide a diversity of freshwater habitats, ranging from drainage dykes alongside the Pocklington Canal to West Beck, the fast-flowing chalk stream near to the Driffield Canal.

TABLE 1
Aquatic plants in watercourses adjacent to the Pocklington Canal, August 2002.

	Pocklington Beck[a]	"East Ings Dyke"[b]	Sop Dyke[c]	Black Drain[d]	"Hall Hills Dyke"[e]
Agrostis stolonifera	+	+	+	+	+
Alisma plantago-aquatica	–	–	+	–	+
Apium nodiflorum	+	+	+	–	–
Callitriche sp.	+	+	+	+	+
Caltha palustris	–	–	–	–	+
Carex acutiformis	–	–	+	–	+
C. riparia	–	–	+	–	+
Eleocharis palustris	–	–	–	–	+
Elodea canadensis	+	–	–	+	–
*Equisetum fluviatile**	–	–	+	–	+
E. palustre	–	–	+	–	+
Galium palustre	–	–	+	–	+
*Glyceria fluitans**	–	–	–	–	+
G. maxima	+	–	+	+	+
*Groenlandia densa**	–	–	+	–	–
Iris pseudacorus	+	–	–	–	–
Juncus articulatus	–	–	+	–	+
*J. conglomeratus**	–	–	+	–	–
J. effusus	–	–	+	+	+
J. inflexus	–	–	–	–	+
Lemna gibba	–	–	–	–	+
L. minor	+	–	+	+	+
L. trisulca	–	–	+	–	+
Mentha aquatica	–	–	–	–	+
Myosotis scorpioides	–	+	+	+	+
*Myosoton aquaticum**	–	–	+	–	–
Persicaria amphibia	+	+	+	+	+
Phalaris arundinacea	+	–	+	+	–
Phragmites australis	+	+	–	–	+
Potamogeton berchtoldii	–	–	–	+	–
P. crispus	–	–	–	+	–
P. pectinatus	+	–	–	–	–
Rorippa nasturtium-aquaticum	–	+	+	–	–
*Rumex hydrolapathum**	–	–	+	–	–
Solanum dulcamara	+	+	+	–	–
Sparganium emersum	+	–	–	–	–
S. erectum	+	+	+	–	+
Typha latifolia	–	–	+	–	–
*Veronica anagallis-aquatica**	–	–	+	–	–
V. beccabunga	+	–	–	–	+
No. of taxa	15	9	26	11	24

[a] Recording in Pocklington Beck was along about 300 m upstream (north) from Canal Head, along about 500 m upstream (east) from Thornton Lock, and along about 200 m upstream (northwest) from a point adjacent to the canal about 250 m north of No. 1 Swingbridge.
[b] Recording in "East Ings Dyke" was along about 300 m upstream (north) and along about 500 m downstream (south) from Coat's Bridge.
[c] Recording in Sop Dyke was along about 500 m upstream (east) and along about 500 m downstream (northwest) from No. 6 Swingbridge.
[d] Recording in Black Drain was along about 400 m downstream (northwest) from No. 6 Swingbridge.
[e] Recording in "Hall Hills Dyke" was along about 500 m downstream (south) from No. 1 Swingbridge.
(+) Indicates present, (–) indicates not recorded.
* Not recorded in the Pocklington Canal.
Names of watercourses in inverted commas are neologisms.

TABLE 2
Aquatic plants in watercourses adjacent to the Driffield Canal, September-October 2002.

	West Beck[a]	Water Forlorns[b]	Nafferton Beck[c]
Agrostis stolonifera	+	+	+
Apium nodiflorum	+	+	+
Berula erecta	+	+	–
Callitriche sp.	+	–	+
*Carex acutiformis**	+	–	+
*Eleocharis palustris**	+	–	–
*Elodea canadensis**	+	–	–
*Equisetum palustre**	+	–	–
Fontinalis antipyretica	+	–	–
*Galium palustre**	+	–	–
*Glyceria fluitans/notata**	+	–	–
G. maxima	+	–	+
Hippuris vulgaris	+	–	–
Iris pseudacorus	+	+	+
*Juncus articulatus**	+	–	–
J. bufonius	+	–	–
J. effusus	+	–	–
J. inflexus	+	–	+
Lemna minor	+	–	+
Mentha aquatica	+	+	–
Myosotis scorpioides	+	+	+
Phalaris arundinacea	+	+	+
Phragmites australis	–	–	+
*Ranunculus penicillatus**	+	–	–
Rorippa nasturtium-aquaticum	+	+	+
Solanum dulcamara	+	–	+
Sparganium erectum	+	–	+
Veronica anagallis-aquatica	+	–	–
V. beccabunga	+	+	+
*Zannichellia palustris**	–	–	+
No. of taxa	28	9	16

[a] Plants were recorded in West Beck where it flows alongside the canal over about 1300 m downstream from Driffield to about GR: TA 041 569.

[b] Plants in the Water Forlorns were recorded at irregular intervals over about 1500 m upstream of its confluence with the canal at River Head.

[c] Plants in Nafferton Beck were recorded over about 800 m upstream from its confluence with the canal at Wansford.

(+) Indicates present, (–) indicates not recorded.

* Not recorded in the Driffield Canal.

It would, therefore, be unsurprising if they supported a distinctive aquatic plant flora. However, the plants that were recorded from adjacent watercourses but not from the canals (Tables 1 and 2) appear all to be species that should potentially be able to colonise the canals, except for *R. penicillatus* which is very much a plant of fast-flowing calcareous streams.

Conclusions relevant to vegetational change and canal management

There have been several earlier surveys of aquatic vegetation along the Pocklington Canal. That of Tolhurst (1987), undertaken in 1986, aimed to appraise the effects of canal restoration. The unrestored half of the canal was used as a control against which the effects of restoration were assessed. This approach, however, was potentially flawed because it failed to account for the downstream half of the canal being phosphate-enriched as well as being restored to navigation. That survey showed that species richness was less in the navigable canal, indeed 44% of the taxa recorded were found only in the unrestored part. Later surveys compared the vegetation in 1990 with that in 1986 (Head, 1991) and the vegetation in 1996 with that in 1990 (Anon., 1997).

Direct comparison of the 2002 data (Fig. 3) with the 1986 survey (Tolhurst, 1987) is not straightforward because different checklists were used. Nevertheless there appear to have been substantial losses of aquatic plant taxa: 12 species have apparently been lost, comprising five submerged species (*Ceratophyllum submersum, Groenlandia densa, Myriophyllum spicatum, Ranunculus aquatilis, Zannichellia palustris*) and seven emergent species (*Alisma lanceolatum, Baldellia ranunculoides, Equisetum fluviatile, Juncus conglomeratus, J. subnodulosus, Myosotis secunda, Veronica anagallis-aquatica*). Only *E. fluviatile* was recorded in the navigable part of the canal in 1986, hence the losses have been predominantly from the unrestored section of canal. Some of the above twelve species may have been missed in 2002 because only sample lengths, 6 km in total, were recorded whereas the earlier surveys were of the whole 14.8 km of canal. Some are likely to be genuine losses. *M. spicatum* and *R. aquatilis* were missing by 1990 (Head, 1991) and *B. ranunculoides* and *C. submersum* by 1996 (Anon. 1997). The possible disappearance of *A. lanceolatum, B. ranunculoides* and *C. submersum*, which have limited distribution in north-east England (Preston & Croft, 1997), represents a significant conservation loss. Some of the species missing from the canal were, however, recorded from adjacent watercourses in 2002; i.e. *E. fluviatile, G. densa, J. conglomeratus, V. anagallis-aquatica* (Table 1).

Six species were found in the Pocklington Canal in 2002 (Fig. 3) that were not recorded in 1986 (Tolhurst, 1987): *Sparganium emersum* and *Juncus articulatus* in the non-navigated section; *Sagittaria sagittifolia* in the navigated section; and *Agrostis stolonifera* (perhaps not on Tolhurst's checklist), *Carex riparia* and *Ranunculus sceleratus* in both sections.

Head (1991) suggested that lower species richness in the restored canal might have been due to over-dredging prior to reopening to navigation. By 2002, however, there was no significant difference in the number of species between navigable and non-navigable 500 m lengths (Fig. 2) and the total number of species in the restored and unrestored sections was much the same. Several processes might have led to this convergence of species richness in the two sections of canal.

Firstly, colonisation of the restored section by lost species during post-dredging recovery. Five taxa that were recorded only in the unrestored canal in 1986 (Tolhurst, 1987) were found in the navigable section in 2002 (*Eleocharis palustris, Elodea nuttallii, Lemna trisulca, Potamogeton lucens, Rorippa nasturtium-aquaticum*).

Secondly, loss of species from the unrestored section probably due to hydroseral succession leading to greater competition from *Glyceria maxima*. This may be more important because 11 of the 12 species apparently lost since 1986 have gone from the unrestored section. Furthermore, six of the taxa that were found only in the navigable canal in 2002 (*Ceratophyllum demersum, Lemna gibba, Potamogeton friesii, Apium nodiflorum, Caltha palustris, Equisetum palustre*) were also recorded in the unrestored section in 1986.

What effect the enrichment by treated sewage effluent had on species richness of aquatic plants in the Pocklington and Driffield Canals is not easy to establish. Since the total number of species in the Pocklington Canal was not significantly different in the enriched (and also navigable) and the non-enriched (and unrestored) 500 m lengths of canal, and there were more floating-leaved and submerged taxa in enriched lengths (Fig. 2), it appears

that enrichment had no deleterious effect on species richness. Perhaps this is because the water was already quite high in nutrients even before it was enriched by the feeder at Thornton Lock. In the Driffield Canal, however, there may have been a direct adverse effect close to the sewage treatment works outfall, leading to reduced species richness of submerged and floating-leaved plants (Fig. 2). The filamentous chlorophycean algae that were especially vigorous in some of the enriched lengths of the Pocklington Canal (Pg-Pj) and throughout the Driffield Canal, and which grossly entangled the macrophytes, may have limited the biomass of the submerged vegetation. Since in neither canal was there an obvious increase in mean Ellenberg's N indicator value in response to input of treated sewage effluent (Fig. 2), there was no clear suggestion that the species composition of aquatic plants changed to favour species that prefer more eutrophic conditions.

The data collected in this study suggest that management of these two canals to favour high species richness of aquatic plants requires the maintenance of open water against the encroachment of emergent marginal plants, particularly *Glyceria maxima*, and the trend towards terrestrialization. Periodic dredging is probably necessary. A long-term management regime might aim to reconcile the maintenance of botanical conservation value with the extension of navigation for light boat traffic. There would need to be agreement to regulate boat traffic should it increase to the extent that it became deleterious to vegetation. Possibly both canals will be protected from undue growth of boat traffic by limited water supply and/or their isolation from the canal network of England and Wales in that they are only reachable over the tidal waters of the Ouse and Humber.

Other constraints on the over-growth of *Glyceria maxima* are also relevant to management. Ideally, the grazing by cattle along parts of both canals (e.g. Lengths Pk, Pl and Da-Dc), leading to poaching of margins and greater diversity of emergent species, should continue. Canal-side trees which shade-out *G. maxima* at the margins, but allow the survival of submerged and floating-leaved vegetation in mid-channel (e.g. in Lengths Pk and Dd), are probably worth preserving. Indeed, a strategy of conserving trees along one side of canals, favouring emergent vegetation only along the unshaded margin, as suggested for management of weed growth in rivers by Jorga *et al.* (1982), might be appropriate.

A management policy towards alien plants may be needed. Antipathy to invaders softens with time (Preston & Croft, 1998), and *Elodea* species are mostly regarded as an uncontroversial component of the British vegetation. Without them, however, the submerged vegetation in these two canals would be very different. The floating fern, *Azolla filiculoides*, first recorded in England in 1886 (Preston & Croft, 1997), can form extensive surface cover in eutrophic waters to the detriment of submerged plants. It was absent from the Pocklington Canal in 1986 (Tolhurst, 1987), was recorded in 1990 (Head, 1991), but had disappeared by 1996 (Anon., 1997) and was not found in 2002. The invasive Indian Balsam, *Impatiens glandulifera*, was observed in summer 2002 along the Melbourne Arm and immediately upstream of Coat's Lock. Control might be appropriate.

Overall, the present study suggests that the conservation of species rich canal vegetation requires the consideration of many factors along with navigation; nutrient enrichment, hydroseral succession, terrestrialization and dredging, bank-side grazing and tree shading, angling, and invasive alien species are all relevant.

Acknowledgements

I am grateful to P. J. Cook and A. Henderson for identifying stoneworts, C. D. Preston for confirming *Potamogeton berchtoldii*, British Waterways, English Nature and land holders for access, the Environment Agency for water analysis data, and A. J. Anderson for comment on the manuscript.

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BOOK REVIEW

Principles of Animal Locomotion by R. McNeill Alexander. Pp. ix + 371, with numerous line drawings. Princeton University Press. 2003. £35.00 hardback.

McNeill Alexander, F.R.S., Emeritus Professor of Zoology at the University of Leeds, is internationally renowned for his work on biomechanics. His latest book provides not only a textbook on animal locomotion but also a definitive reference work for researchers. His overview covers most animal groups, from worms to whales, and all media (land, water and air) to show how animals run, walk, jump, swim, crawl, soar, hover and fly. Although much is of a technical nature, this work is highly readable, the author conveying his enthusiasm to a wide audience. One novel aspect of this book is the coverage of both unaided and aided human movement, with such topics as oars, hydrofoils, jet propulsion, shoes, bicycles and boats receiving his expert attention. An extensive bibliography (33 pp.) supports a comprehensive review of the best way to travel, energy requirements, consequences of size differences and the many different ways of moving on and through different media, much of the information gained from the author's own researches. A classic that should be on all zoological library shelves.

MRDS

ARE MOTH NUMBERS DECLINING? EVIDENCE FROM MOTH TRAPPING IN HEADINGLEY (LEEDS), WEST YORKSHIRE

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Introduction

In their review of changes in the status of Yorkshire Lepidoptera, Sutton and Beaumont (1989) found that five times as many species of butterflies and macro moths had experienced expansion of range as had undergone contraction since publication of the Yorkshire Naturalists' Union list in 1967-1970 and concluded that there had been a "significant increase in the breeding range of a large number of species in the last twenty years". They speculated that this might be a consequence of global warming. While there was at the time no conclusive evidence that such warming was occurring they reasoned that, if it were taking place, "butterflies and moths may be good indicators of its effects on wildlife communities". However, they cautioned that some of the predictions of changes in weather patterns, producing cloudier, wetter weather, were "hardly the conditions likely to encourage southern species to expand their range in Yorkshire, as seems to have happened".

Climate change has already begun (Yorkshire and Humber Assembly, 2002). The latest predictions are that climate change in the Yorkshire and Humberside Region will be characterized by wetter winters, drier springs and hotter summers, giving a longer growing season. There will be greater climate variability and a higher incidence of extreme events implying, among other things, a higher incidence of severe floods. If experience of the past decade is any guide, drier springs are not the same thing as warmer springs. Northerly airstreams, often with heavy cloud cover, have persisted until well into June and even, in 2002, into early July. While day-time temperatures have risen, night-time temperatures have often been low. The impact of climate change on the abundance and species diversity of moths in these circumstances is likely to be complex.

There has been no follow up to the assessment of Sutton and Beaumont (1989) on the changes in Yorkshire macro Lepidoptera. The published update (Beaumont, 2002) provides "a brief interim statement on the status of each species in what appears to be a rapidly changing situation in response to a warmer climate, and weather becoming more prone to extremes", but does not attempt to summarise this information or to comment on the trends detected by the earlier work.

A contrast to the, albeit qualified, optimistic view of Sutton and Beaumont (1989) is given by the preliminary analysis of trends in catches from the UK's longest-running light trap at the Rothamsted Research Station in Hertfordshire. This suggests a considerable decline in night-flying macro moths, with a 60% reduction in total catches since the 1930s and even larger reductions of certain species over the last 30 years (Butterfly Conservation, 2003). Conversations with Yorkshire moth trappers suggests a general view that there has been a decline in catch sizes and in the abundance of macro moths in Yorkshire in recent years. While such a decline, if it has occurred, is not incompatible with an increase in species diversity as a result of range extension, it would none the less be surprising. This paper uses moth trapping data from Headingley, Leeds to investigate recent shorter term trends in catch size and number of species caught.

Trap Operation

The Headingley moth trap has operated since 1976 from a north facing second floor window of a house on Headingley Hill, 2 km north of Leeds City centre. The window is *c.* 12 m above ground level and looks onto mature trees in a small walled garden in a well wooded area with many other mature gardens. The trap is operated on about 100 days a year. In all but two years, weather and family circumstances permitting, it has been

operated throughout June and July. Operation in August has been less complete, but coverage from September – early November (weather permitting) has been good. In spring the trap is operated sporadically from March to May when nights are thought to be suitable.

Records of macro moths of the families Hepialidae; Cossidae, Lasiocampidae, Thyratiridae, Geometridae, Sphingidae, Notodontidae, Lymantriidae, Arctiidae, Nolidae and Noctuidae, are continuous between 1976 and 2002. The day-flying Zygaenidae and Sesiidae are not represented: indeed, none occur in the immediate vicinity. Nomenclature is that of Skinner (1998). The number of individuals of each species caught on each trapping night was recorded. While it is believed that this is one of the longest runs of urban moth trap records in the UK, there are some constraints on the data. In the early years the trap was a Heath portable, powered by a car battery, replaced in 1983 by a mains powered Robinson trap with a 'black' bulb. Breakdown in late 1988 resulted in reversion to the Heath trap until early June 1989, since when a Robinson with a white bulb has been used. The pulling power of the Heath trap is about a third of that of the white bulb Robinson and the black bulb is intermediate between the two. Changing the system thus introduces a variable that may influence the number of individuals caught in different time periods but probably not the trend. Different species possibly react to different light intensities in different ways.

Up to the end of 2002 the number of species of macro moths was 235. Table 1 summarises data from 1993 to 2002. The most striking feature to emerge from the data is that only 28 species, 12% of the total, were recorded every year and may with some confidence be supposed to be resident in or near the collecting area of the trap. A cut-off of 70% recording frequency (i.e. recorded in 7 or more years out of 10) would add another 22 species (9% of the total) to the residents. Resident species are listed in Appendix 1. The other 185 are classed as accidentals; they may breed somewhere in the area but not sufficiently close to the trapping point to give a substantial probability of being trapped. They include a few species that are not much attracted to light, e.g. the Ghost moth (*Hepialis humuli*) whose larvae are found close to the trapping point but whose adults are rarely trapped. The number of accidentals increases annually. Additional species have been recorded every year since 1976 except 2002. Over the period of operation of the white bulb Robinson trap, the mean annual catch has been 1401 individuals of 92 species (Table 2). Thus over 50% of the total species caught each year are accidentals.

TABLE 1
Species recording frequency 1993-2002

Recording frequency	**Number of Species**	**% of total**
Every year	28	12.0
9 years out of 10	11	4.7
8 years out of 10	6	2.6
7 years out of 10	4	1.7
< 7 years out of 10	185	79.1

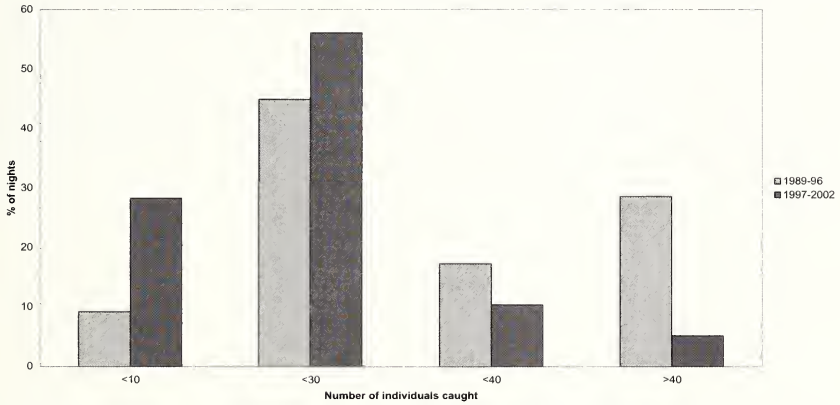
Catch Trends

Most captures are made in high summer, from mid-June to the end of July. Large numbers of individuals but typically smaller numbers of species, are caught in August, but the August coverage is less complete. The analysis concentrates on June 21-July 31 for the period of operation of the white bulb Robinson trap, 1989-2002. Operation of the trap was not extensive in 1994 so this year is omitted from consideration. Basic data on the distribution of catch sizes (the number of individuals caught per night) are given in Table 3. Figure 1 compares catch sizes for 1989-1996 with those for 1997-2002. In the early part of the period there were many fewer small catches and many more large catches. Fewer than

TABLE 2
Catches with the white bulb Robinson trap

	Number of Nights	Total Catch	Number of Species
1989	72	1017	94
1990	70	1148	79
1991	107	2071	112
1992	125	2707	127
1993	109	1261	90
1994	68	821	80
1995	128	1711	107
1996	56	1183	57
1997	142	1551	105
1998	150	1251	94
1999	74	1077	85
2000	134	2232	106
2001	100	625	70
2002	98	960	80
Mean	**102**	**1401**	**92**

FIGURE 1
Number of individuals caught per night in summer trapping (21 June-31 July)



10 individuals were caught on only 9% of nights in 1989-1996, but on 28% of nights in 1997-2002. At the other extreme, more than 40 individuals were caught on 29% of the nights in 1989-1996, but on only 5% of nights in 1997-2002.

To determine whether the decline in catches was statistically significant the mean catch size was regressed on time. This confirmed that catch size was indeed declining.

Regression of mean catch (m) and time (t):

$m = 39.3^* - 1.78^*t;$ (1)
(3.17)

$r^2 = 0.501$; $F = 10.04$. Significance level = 0.008

Numbers in brackets beneath parameters are Student 't' statistics.

*= parameter is significant at the 0.05 level on a t test.

According to this equation the expected catch size of a night's trapping in high summer

TABLE 3
Number of Individuals caught per night in summer (21 June to 31 July)

Catch size	1989	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	2001	2002
<10	8	1	1	0	4	3	1	3	12	6	8	15	5
<30	16	15	15	6	11	12	11	15	23	13	19	13	14
<40	3	6	8	7	2	6	2	4	2	8	1	1	2
>40	7	1	6	20	3	11	8	2	0	5	1	1	0
Median	19	29	29	45	25	31	28	22	14	27	16	10	13
Mean	21.9	27.5	29.4	46.5	23.6	32.4	34.4	21.7	15.3	25.5	14.6	12.3	14.4
Total Catch	767	769	910	1582	637	1070	791	542	595	842	454	380	316

in 1989 (t = 1) was 37.52 (39.3-1.78) By 2002 (t = 14) it had declined to 14.38, a reduction of 38%. On average the trap is operated for 30 nights over this high summer period. Thus the predicted total catch for a 30-night operation in high summer declined from 1126 in 1989 to 432 in 2002, a reduction of 694 individuals. This is dramatic, if not catastrophic.

With so few observations there is a possibility of the result being affected by extreme values. Although a scatter diagram does not suggest that this is a problem, a non–parametric test for trend was carried out. Spearman rank correlation coefficient between means and time = 0.654. With 13 observations this is significant at the 1% level on a Student t test [$t \surd r_S \cong (n-2)/(1- r_S^2)$ with n-2 degrees of freedom], confirming the previous result.

This downwards trend in catches is not caused by any changes in the way the trap was operated. There is no trend in the frequency of trap operations over the period and in any case mean catch size is unrelated to the frequency of trap operations ($r^2 = 0.002$).

Has this decline in size of catches been matched by a decline in their species diversity? Figure 2 graphs the number of species caught each year in the summer trapping season (21 June-31 July). In order to determine whether species diversity has declined it is necessary to control for catch size (the number of individuals caught).

FIGURE 2
Total species caught in summer trapping

It was hypothesised that there is a positive relationship between total catch size (TC) and number of species caught (n), both being subject to the same determining influences, presumably in part at least, climatic ones. The linear relationship between the variables is:

$n = 36.2^* + 0.03TC^*$ (2)

(5.3) (5.3)

$r^2 = 0.717$; F = 27.9; Significance level 0.0002%

Durbin-Watson (DW) Statistic 1.99

On the conventional diagnostic tests for time series regression the equation is robust and the coefficient on TC is significant and of the right sign. Autocorrelation of residuals is firmly rejected by the DW statistic. The regression thus confirms the hypothesis. Figure 3 shows the actual number of species caught and the number predicted from equation 2. The equation tracks the data well and 72 % of the variation in species diversity is explained by variation in catch size.

Equations (1) and (2) can be combined to illustrate the size of this decline in species diversity. In 1989 the expected high season catch for 30 nights of trap operation was 1126 individuals. Equation 2 shows that this catch would have comprised 70 species. The same volume of trap operations in 2002 would have produced 432 specimens of 49 species. In summary, the statistical analysis reveals that over the 14-year period 1989 to 2002, the number of individuals caught in a night's trap operation declined by 38% and the number of species caught by 30%. In the succeeding sections an attempt has been made to describe the catch trend more precisely as a step towards understanding its causes.

FIGURE 3
Predicted and actual numbers of species caught in summer trapping
(n = 36.2 + 0.03TC)

Analysis by Family

Over 95% of the high season catch is comprised of species of two families, Geometridae and Noctuidae. Figure 4 graphs total catches of these families. There is a striking and statistically significant decline in catches of Noctuidae, but no trend in catches of Geometridae.

Trends for Individual Resident Species

For purposes of analysis the resident species were divided into four categories:

Summer resident species – June and July catch – ≥ 90% of the total catch.

Long season resident species – 90% of the catch is made in a period of 3 months or more, at least one month of which is either June or July.

TABLE 4
Statistical trends in catches of resident species

	Const.	Regrssion	R^2	F	Trend Significant
1. Summer residents					
Bright-line	16.5*	–0.96	0.270	4.06	Yes (10%)
Brown-eye	(4.4)	(2.01)			
Cabbage Moth	62.0	–4.62*	0.436	8.50	Yes (5%)
		(4.9)	(2.91)		
Common Rustic	102.7*	–7.01*	0.348	5.88	Yes (5%)
		(4.4)	(2.42)		
Dark Arches	233.5*	–16.10*	0.414	7.80	Yes (5%)
		(5.1)	(2.79)		
Heart & Dart	303.3*	–22.79*	0.431	8.32	Yes (5%)
		(4.8)	(2.89)		
Green Pug	18.3*	–0.50	0.139	1.77	No
		(4.4)	(1.33)		
Marbled beauty	80.3*	–2.66	0.137	1.74	No
		(5.01)	(1.32)		
Pale Mottled	8.1*	–0.13	0.123	1.55	No
Willow	(5.8)	(1.24)			
Riband Wave	96.0	–4.66	0.147	1.90	No
		(3.6)	(1.37)		
2. Long-season residents					
Garden Carpet	270.1*	–5.79	0.059	0.70	No
		(4.89)	(0.83)		
Large Yellow	16.2	17.03	0.149	1.92	No
Underwing	(0.2)	(1.39)			
3. Autumn residents					
Common Marbled	3.5	+0.038*	0.384	6.85	Yes (5%)
Carpet	(2.2)	(2.62)			
Mouse Moth	47.1*	+0.634	0.010	0.09	No
		(2.9)	(0.30)		
Square-Spot	0.60	+0.998	0.176	1.92	No
Rustic	(0.1)	(1.39)			
Svensson's	11.9	+4.47*	0.460	7.67	Yes (5%)
Copper Underwing	(1.0)	(2.77)			
4. Spring residents					
Clouded Drab	5.5	–0.242	0.032	0.37	No
		(1.8)	(0.61)		
Common	16.5	+0.387	0.005	0.05	No
Quaker	(1.7)	(0.23)			
Early Grey	6.0	0.066	0.002	0.02	No
		(1.7)	(0.15)		
Hebrew	19.1	–1.253	0.176	2.35	No
Character	(2.9)	(1.53)			

FIGURE 4
Summer catches of the most abundant families

Autumn resident species – ≥ 90% of the catch is made after July.
Spring resident species – ≥ 90% of the catch is made before June.

Statistical trends were estimated for resident species whose numbers are large enough to make analysis possible. Thus a species where 1 or 2 individuals are caught every year cannot be analysed in this way.

Category 1: Summer Residents

Summer catches are dominated by relatively large numbers of a few resident species. Hence it seems likely that the downward trends detected for the catch as a whole should be reflected in the numbers of individual species.

The results are provided in the first part of Table 4; statistical significance is indicated in the right-hand column. All species analysed show evidence of a decline in frequency. The three commonest species that provide the greatest proportions of a typical catch are all Noctuidae: Heart and Dart (*Agrotis exclamationis*), Dark Arches (*Apamea monoglypha*) and Common Rustic (*Mesapamea secalis*). They all show significant downward trends, as does Cabbage Moth (*Mamestra brassicae*), a species common in the 1970s and 1980s but now infrequent. Bright-line Brown-eye (*Lacanobia oleracea)* shows a significant downwards trend at the 10% level often used with small numbers of observations. The other summer resident Noctuidae, Marbled Beauty (*Cryphia raptricula*) and Pale Mottled Willow (*Caradrina clavipalpis*), have negative but non-significant trends. The two Geometridae that occur in significant numbers, Riband Wave (*Idaea aversata*) and Green Pug (*Chloroclystis rectangulata*), also have negative but non-significant trends.

According to Table 4, the expected catch of this group of summer resident species fell by 77% between 1989 and 2002, substantially more than the 38% fall in the total summer catch. Two factors account for the difference: (1) the number of accidentals was (comparatively) buoyant as indicated by the smaller (30%) decline in predicted species diversity and (2) the long-season resident species did not decline.

Category 2: Long-season Residents

Only two species are involved and their biology is markedly different. The Large Yellow Underwing (*Noctua pronuba*) first appears in late June or early July and continues until well into the autumn, often October. The Garden Carpet (*Xantherrhoe fluctuata*) is multi-brooded. The first brood is usually the largest and extends from mid-May to early June. There is a second

brood from late June to early July and one or two broods in September and October. Large Yellow Underwing numbers fluctuate wildly between years and in good years it is the most abundant species in the trap. Garden Carpet numbers are always high and it is normally the most abundant species. Neither species shows any significant trend over the period of analysis.

Category 3: Autumn Residents

In contrast to the weather in early summer, late summer and autumn in recent years have usually been good, with extended warm dry periods extending even into October, corresponding to the longer growing season predicted as a result of global warming. In these circumstances we might look for positive rather than negative trends in catches, and this is indeed the case. There are 5 autumn resident species. All show positive trends over the period; Svensson's Copper Underwing (*Amphipyra berbera svenssoni*) and Common Marbled Carpet (*Chloroclysta truncata*) significantly so. It should be noted that the number of autumn resident moths is small in comparison with summer resident species so positive trends do not offset the falls in high season catches.

Category 4: Spring Residents

The trap is set for spring species whenever the weather appears to be suitable, meaning usually that the nights are relatively warm and dry, as indicated by a thermometer mounted outside the trapping window and the weather forecast. Trapping periods are usually short, a few days, and can occur any time from late February to late April. Experience has shown that a more systematic approach to running the trap leads only to a sequence of zero catches. The impression from this opportunistic approach to trapping, that when the weather is right the moths can be caught, is confirmed by the results (Table 4). There are four spring resident species but in only two of them do catches reach double figures. No species shows a statistically significant trend in catches.

Conclusions

1. Analysis of data collected by the Headingley moth trap shows that aggregate catches of macro moths in the high summer period (mid-June to the end of July) have declined significantly since the late 1980s.
2. This has been accompanied by a significant decline in the number of species caught.
3. Of the two best represented families the downward trend applies to noctuids but not to geometrids, which show no trend over the period.
4. The downward trend in total catches has arisen from a decline in the catches of the major resident species that constitute the bulk of the catch.
5. Resident species with a season that extends beyond the high summer period have not similarly declined.
6. Catches of spring species show no evidence of decline.
7. By contrast catches of autumn resident species have increased over the same period.
8. While the data are inadequate in duration and volume for detailed analysis to determine causes, it is suspected that the decline in numbers of summer residents is due to a succession of cold, and frequently wet, early summers. The positive growth in catches of autumn resident species is thought to be the result of warm, dry autumns. Whether these two phenomena are aspects of long-term climate change is unclear.

Acknowledgements

I am greatly indebted to Prof. Geoffrey Fryer and Prof. Mark Seaward for the considerable amount of time they spent on this paper and for their many helpful comments.

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APPENDIX 1.
Resident species of the Headingley moth trap

(a) Recorded every year	
Ash Pug	*Eupithecia fraxinata*
Bright-line Brown-eye	*Lacanobia oleracea*
Brimstone Moth	*Opisthograptis luteolata*
Brindled Pug	*Eupithecia abbreviata*
Cabbage Moth	*Mamestra brassicae*
Common Marbled Carpet	*Chloroclysta truncata*
Common Pug	*Eupithecia vulgata*
Common Quaker	*Orthosia stabilis*
Common Rustic	*Mesapamea secalis*
Dark Arches	*Apamea monoglypha*
Double-striped Pug	*Gymnoscelis rufifasciata*
Garden Carpet	*Xantherrhoe fluctuata*
Green Pug	*Chloroclystis rectangulata*
Grey Dagger	*Acromicta psi*
Grey Pug	*Eupithecia subfuscata*
Heart and Dart	*Agrotis exclamationis*
Hebrew Character	*Orthosia gothica*
Large Yellow Underwing	*Noctua pronuba*
Light Emerald	*Campaea margaritata*
Marbled Beauty	*Cryphia raptricula*
Mouse Moth	*Amphipyra tragopoginis*
Riband Wave	*Idaea aversata*
Silver Y	*Autographa gamma*
Slender Pug	*Eupithecia tenuiata*
Small Dusty Wave	*Idaea seriata*
Svensson's Copper Underwing	*Amphipyra berbera svenssoni*
Swallow-tailed Moth	*Ourapterix sambucaria*
The Dun-bar	*Cosmia trapezina*
(b) Recorded in 9 years out of 10	
Angle Shades	*Phlogophora meticulosa*
Clouded Drab	*Orthosia incerta*
Figure of Eighty	*Tethea ocularis octogesimea*
Pale Mottled Willow	*Caradrina clavipalpis*
Peppered Moth	*Biston betularia*
Rustic Shoulder-knot	*Apamea sordens*
Scalloped Oak	*Crocallis elinguaria*
Tawny Marbled/Rufous Minor	*Oligia latruncula/veriscolor*
The Snout	*Hypena proboscidalis*
The Uncertain	*Hoplodrina alsines*
Willow Beauty	*Peribatodes rhomboidaria*

(c) Recorded in 8 years out of 10

Burnished Brass	*Diachrysia chrysitis*
Dusky Brocade	*Apamea remissa*
Early Grey	*Xylocampa areola*
Scalloped Hazel	*Odontoptera bidentata*
Silver-ground Carpet	*Xantherhoe montanata*
Smoky Wainscot	*Mythimna impura*
The Rustic	*Hoplodrina blanda*

(d) Recorded in 7 years out of 10

Common White Wave	*Cabera pusaria*
Feathered Thorn	*Colotois pennaria*
Lesser Yellow Underwing	*Noctua comes*
Small Phoenix	*Ecliptoptera silaceata*

BOOK REVIEW

The Selborne Pioneer. Gilbert White as Naturalist and Scientist: a Re-examination by Ted Dadswell. Pp. xix + 238, plus 12 pp. of b/w plates. Ashgate, Aldershot. 2003. £45.00 hardback.

That Gilbert White's *The Natural History of Selborne* (written and rewritten between 1770 and mid-1788) is a delightful evocation of 18th century country life has never been questioned, but the mythology which has grown up regarding the portrayal of the author and the scientific value of his major work has received some criticism. One reviewer of the 1977 reprint of White's *Natural History*, the fourth most published book in the English language, goes so far as to say that the work is "strong on topographical description but overrated in respect of scientific observation".

Ted Dadswell sets out to dispel these criticisms by endeavouring to demonstrate that White was a scientific naturalist, his achievements gained, amongst other things, through "taxonomy and dissection" (p. 156), "brilliance of first-hand recording" (p. 160) and "use of the control" (p. 161). The author warns us against becoming mesmerized by lists (p. 163), but nevertheless shows us that within a parish of only 8 or 9 square miles White identified 120 species of birds (nearly half of the species known to occur in Britain at that time) and 440 wild plants. The reviewer is not wholly convinced by the author's argument that "White was himself experimentally minded: he did not take received wisdom, unsupervised observation, or even his own first impressions on trust" (p. 109), particularly when set against such points as White "made little or no use of the telescope and was wary of the microscope" (p. 154). However, it is clear that White was a pioneer in terms of his behavioural and topographical studies, his observations on animals, and the deductions he made from these, often illuminating in terms of modern thinking.

The book is well written, but, in the reviewer's opinion, it is illogical in its presentation; the value of the appendices and some of the plates is questionable (note also that nos. 9-13 to be inserted between pages 172 and 173 (p. vii), actually appear before p. 109) and some errors (e.g. it's for its) have been noted.

Despite its relatively high price, this is a thoughtful book, supported by extensive textual notes and a valuable bibliography, which assesses White's approach to recording and his scientific achievements and provides an insight into an 18th century naturalist at work.

MRDS

THE SPIDER FAUNA OF ASKHAM BOG, YORK, AND THE ASSESSMENT OF CONSERVATION VALUE

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Summary
A survey of the arachnofauna of Askham Bog Nature Reserve, York, was undertaken in May 1999, prior to significant management changes. The species list obtained was compared with that compiled by Clifford Smith, who collected from the site around 1960. Other invertebrate groups (Coleoptera, Diptera, Isopoda, Chilopoda and Diplopoda), collected incidentally in pitfall traps, were also identified. Average rarity scores and the 'naturalness' for Askham Bog spiders are calculated and compared with those of other lowland bogs. These indices can be used to assess the habitat quality and conservation importance of the Reserve for invertebrates in general.

Introduction

Askham Bog is a Yorkshire Wildlife Trust (YWT) Nature Reserve lying approximately 5 km to the S.S.W. of York Minster (centered on SE571480). It was the first Reserve to be acquired by the Yorkshire Naturalists' Trust (as it was then) in 1946. Indeed, its preservation and conservation was the reason the Trust was established. The site is now designated as a Site of Special Scientific Interest.

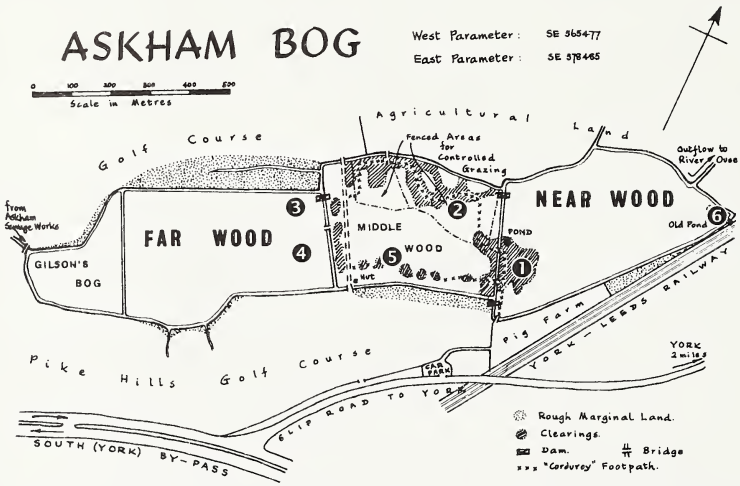
Askham Bog holds a special significance in the history of arachnology for it was from here that Martin Lister (1638-1712), a York doctor, recorded the species now known as *Achaearanea lunata* (Theridiidae) in his *Tractus de Araneis* published in 1678 (Parker & Harley, 1992). This was one of the very first locality records for a spider anywhere in the world. Three hundred years later, the late Clifford Smith collected extensively at Askham Bog (*c.* 1960) and produced lists of its arachnofauna (Smith, 1962; Fitter & Smith, 1979).

In 1998, the YWT obtained a substantial Heritage Lottery Grant towards urgent capital works on a number of its nature reserves. A large proportion of this was earmarked for Askham Bog, where it was to be spent, *inter alia*, on safeguarding the water level and quality so necessary for the continuation of the Bog community. A detailed summary of the history and natural history of Askham Bog was published by Fitter and Smith (1979), but it was considered highly desirable to obtain an updated picture of the species found on the Bog prior to the restoration work. The present survey of the arachnofauna (and other incidental species) was organised under the auspices of the British Arachnological Society and took place on 30 March 1999.

The conservation value of natural habitats can be assessed and compared in a variety of ways (e.g. Margules & Usher, 1981; Ball, 1992; Eyre, 1996; Eyre & Woodward, 1996; Scott, 2001). In the present context, Scott (2001), using data from 40 Welsh mires, showed that there was a strong correlation between the number of spider indicator species (i.e. those characteristic of bog habitats) and the number of Red Data Book and Notable species in other invertebrate taxa. Indices derived from the arachnofauna of a site can therefore be used to provide an indication of the conservation importance of that site for invertebrates in general. The data collected on the spiders of Askham Bog in 1999 and earlier are used in this way to determine the value and 'naturalness' of the Reserve as a wetland habitat.

Description of the Reserve

Askham Bog occupies a depression created by glacial debris left during the Ice Age. The south-eastern edge of the depression is defined by a glacial moraine which links the Yorkshire Wolds with the Pennines through York. Water drains into the Bog from the slightly higher surrounding ground, and leaves by a small stream which eventually flows into the River Ouse. Askham Bog originally formed as a raised bog but its subsequent history meant that it reverted to a fen, of a type now rare in northern England (Fitter & Smith, 1979). The Bog originally consisted of six parts. Since the 1950s, the two nearest to the City of York have been reclaimed and developed; unfortunately they were the richest areas from an entomological perspective. The present Reserve is divided into three major compartments, from north-east to south-west, Near Wood, Middle Wood and Far Wood. The latter also incorporates the sixth part, Gilson's Bog, which has ceased to be recognised as a separate entity. These areas are largely delimited and separated by water-filled dikes (Figure 1). The total area of the Reserve is some 44.7 hectares.



Map of Askham Bog showing the three main compartments, Far, Middle and Near Woods, and the positions of sites sampled within each during the current survey. The map is based on a figure in Fitter and Smith (1979), and is reproduced here with permission.

Sampling sites and methods

The three main areas of Askham Bog, Near, Middle and Far Woods, differ in terms of their vegetative characteristics and structure (Fitter & Smith, 1979). The sampling strategy during the present survey was to investigate in detail two sites within each of the three Woods. A general description of the vegetation at the six sampling sites is given in Table 1 and their locations indicated on Figure 1.

Nine surveyors spend an entire day sampling the Reserve. The original plan, which slipped only a little, was to spend about one hour sampling at each site. Collection methods deployed were sweep-netting, sieving, beating, direct observation and grubbing (close investigation of the ground vegetation on hands and knees), but these were used to different extents by individual surveyors. In addition, in each of Sites 1 to 5, five pitfall traps were set five days prior to the survey (i.e. on 25 May 1999). These traps consisted of plastic drinking cups, 7 cm diameter at the top and 7.5 cm deep, half filled with 70% antifreeze containing a few drops of detergent. The traps were placed in a line, with *c.* 5 m between trapping positions, and each was covered by a wooden rain-guard. The traps were lifted on the day of the survey, and the

TABLE 1.
Description of the sampling sites at Askham Bog

Site 1: A glade dating from *c.* 1973. Fen meadow, cut and raked annually. Dominant vegetation: some purple moor-grass (*Molinia caerulea*) and dwarf sedge (*Carex humilis*) with carnation sedge (*Carex panicea*), otherwise a rich mix of common meadow-rue (*Thalictrum flavum*), yellow loosestrife (*Lysimachia vulgaris*), common reed (*Phragmites australis*), brown sedge (*Carex disticha*), meadowsweet (*Filipendula ulmaria*) and purple small-reed (*Calamagrostis canescens*). Sphagnum moss present in wetter areas. Some small, open-water pools.

Site 2: An old clearing, grazed annually by cattle for probably a decade. Sedge swamp and ex-scrub dominated by purple small-reed (*Calamagrostis canescens*), greater pond sedge (*Carex riparia*) with some woodland plants like bramble (*Rubus fruticosus* agg.) and broad buckler fern (*Dryopteris dilatata*).

Site 3: Alder carr/oak and birch woodland, *c.* 110 years old. Understorey of rough meadow grass (*Poa trivialis*), stinging nettle (*Urtica dioica*) and some fen plants like meadowsweet (*Filipendula ulmaria*).

Site 4: Oak/birch woodland, *c.* 110 years old. Fairly dry with honeysuckle (*Lonicera periclymenum*), holly (*Ilex aquifolium*) and an understorey dominated by a sparse layer of common reed (*Phragmites australis*).

Site 5: Clearing (c. 25 years old) on edge of birch, *Molinia*/birch and oak woodland (probably <70 years old) with some willow (*Salix* spp.), alder buckthorn (*Frangula alnus*), rowan (*Sorbus aucuparia*) and bog myrtle (*Myrica gale*) in shrub layer. Field layer with rough meadow grass (*Poa trivialis*), sphagnum moss and bramble (*Rubus fruticosus* agg.).

Site 6: The Old Pond, dug in *c.* 1910, since silted and dominated by *Phragmites* fen. Other abundant species include fen bedstraw (*Galium uliginosum*), purple small-reed (*Calamagrostis canescens*), stinging nettle (*Urtica dioica*) and yellow loosestrife (*Lysimachia vulgaris*).

contents preserved in 70% ethanol. All spiders collected were identified by Alan Scott, Tom Faulds or Trevor Harris.

Results

The species recorded during the survey, and the sites at which they were found, are given in Table 2. Nomenclature follows the checklist of Merrett and Murphy (2000). Also shown in Table 2 are the species in Clifford Smith's checklists (Smith, 1962; Fitter & Smith, 1979, appendix 11; Smith, unpublished notebook). For completeness, lists of species in other groups captured in pitfall traps are given in Appendix 1.

Smith recorded 151 species, whereas the number found in the present survey was 118. Taking the 1999 and Smith's lists together, a total of 175 spider species have been recorded at Askham Bog, 101 of them linyphiids (*Segestria senoculata* was recorded in 1999 on the path down to the Bog, and is not included in the totals). Table 3 details the species present on Smith's list, but not found in the present survey, and also those found in 1999 that had not previously been recorded. On the combined list, one species is designated as Nationally Notable 'Na' (*Entelecara omissa*) and another as 'Nb' (*Porrhomma oblitum*). The former was recorded by Smith, but not during 1999, whereas the latter was found at two sites in 1999, but not by Smith. Pitfall trapping contributed surprisingly few additional species over and above other collecting methods. Only two out of 118 species were found exclusively in pitfalls (*Saaristoa abnormis* and *Lepthyphantes leprosus*, both at Site 5) and only small numbers were added to the separate site lists by this means (*Robertus lividus* and *Diplostlya concolor* at Site 2; *Ozyptila trux*, *Robertus*

TABLE 2.
Species found in the six sample sites surveyed in 1999, and those previously found by Clifford Smith (Smith, 1962; Fitter & Smith, 1979; Smith, unpublished).

Family	Species	Status	1	2	3	4	5	6	Smith
Segestriidae	*Segestria senoculata* (Linnaeus) *	–							
Mimetidae	*Ero cambridgei* (Kulczynski) †	Common		+					+
	Ero furcata (Villers)	Common							+
Theridiidae	*Steatoda bipunctata* (Linnaeus)	Common							(+)
	Anelosimus vittatus (C. L. Koch)	Common	+	+					+
	Achaearanea sp. **	–				+			
	Theridion sisyphium (Clerck)	Common		+					+
	Theridion impressum (L. Koch)	Local							(+)
	Theridion pictum (Walckenaer) †	Local		+					+
	Theridion varians Hahn	Common		+					+
	Theridion mystaceum L. Koch	Common							+
	Theridion tinctum (Walckenaer)	Local			+	+			
	Neottiura bimaculata (Linnaeus)	Common	+	+			+	+	+
	Paidiscura pallens Blackwall	Common	+	+	+	+	+		+
	Enoplognatha ovata (Clerck)	Common	+	+	+	+	+		+
	Robertus lividus (Blackwall) †	Common	+	+	+	+	+		+
	Robertus neglectus (O. P.-Cambridge)	Nr				+			
	Robertus arundineti (O. P.-Cambridge) ‡	Nr							+
	Pholcomma gibbum (Westring)	Common							+
Linyphiidae	***Ceratinella brevipes*** (Westring)	Common							+
	Ceratinella brevis (Wider)	Common							+
	Ceratinella scabrosa (O. P.-Cambridge)	Nr			+				+
	Walckenaera acuminata Blackwall	Common							+
	Walckenaera atrotibialis (O. P.-Cambridge) †	Local				+	+		
	Walckenaera nudipalpis (Westring) †	Common							+
	Walckenaera furcillata (Menge)	Nr			+				
	Walckenaera unicornis (O. P.-Cambridge)	Common	+					+	+
	Walckenaera kochi (O. P.-Cambridge) †	Local							+
	Walckenaera vigilax (Blackwall)	Local	+						+
	Dicymbium nigrum (Blackwall)	Common	+	+			+		+
	Dicymbium tibiale (Blackwall)	Common		+	+	+	+		+
	Entelecara acuminata (Wider)	Common		+		+	+		+
	Entelecara erythropus (Westring)	Common			+	+			+
	Entelecara omissa (O. P.-Cambridge)	Na							+
	Hylyphantes graminicola (Sundevall)	Local		+	+		+		+
	Gnathonarium dentatum (Wider)	Common							+
	Gongylidium rufipes (Sundevall)	Common			+	+	+		+
	Dismodicus bifrons (Blackwall)	Common	+	+			+	+	+
	Hypomma bituberculatum (Wider)	Common	+						+
	Hypomma cornutum (Blackwall)	Local				+			+

Family	Species	Status	1	2	3	4	5	6	Smith
Linyphiidae	*Baryphyma pratensis* (Blackwall)	Local							+
	Gonatium rubens (Blackwall)	Common				+			+
	Maso sundervalli (Westring) †	Common	+	+	+	+	+	+	+
	Pocadicnemis pumila (Blackwall) †	Common	+	+			+		+
	Pocadicnemis juncea Linnaeus	Common	+	+			+	+	+
	Oedothorax gibbosus (Blackwall) †	Common	+	+	+				+
	Oedothorax fuscus (Blackwall)	Common							+
	Oedothorax retusus (Westring)	Common							+
	Pelecopsis parallela (Wider) †	Local							+
	Silometopus elegans								
	(O. P.-Cambridge)	Common	+	+				+	+
	Silometopus reussi (Thorell)	Local						+	
	Cnephalocotes obscurus (Blackwall) †	Common	+						
	Tiso vagans (Blackwall)	Common							+
	Tapinocyba pallens								
	(O. P.-Cambridge)	Common				+			+
	Monocephalus fuscipes (Blackwall)	Common							+
	Gongylidiellum vivum								
	(O. P.-Cambridge) †	Common	+		+		+		+
	Micrargus herbigradus (Blackwall)	Common		+	+				+
	Erigonella hiemalis (Blackwall)	Common			+				+
	Savignia frontata (Blackwall)	Common	+		+			+	+
	Diplocephalus permixtus								
	(O. P.-Cambridge)	Common			+				+
	Diplocephalus latifrons								
	(O. P.-Cambridge)	Common			+				+
	Diplocephalus picinus (Blackwall)	Common	+	+	+	+			+
	Araeoncus humilis (Blackwall)	Common							+
	Erigone dentipalpis (Wider)	Common			+				+
	Erigone atra (Blackwall)	Common			+				+
	Erigone promiscua (O. P.-Cambridge)	Local			+				
	Erigone arctica (White)	Local							+
	Erigone longipalpis (Sundevall)	Local			+				
	Leptorhoptrum robustum (Westring)	Local			+				+
	Drepanotylus uncatus								
	(O. P.-Cambridge)	Local							+
	Ostearius melanopygius (Blackwall)	Local							+
	Aphileta misera (O. P.-Cambridge)	Local	+			+			+
	Porrhomma pygmaeum (Blackwall)	Common		+	+	+	+	+	+
	Porrhomma convexum (Westring)	Local							+
	Porrhomma pallidum (Jackson)	Local				+	+		+
	Porrhomma oblitum								
	(O. P.-Cambridge) †	Nb	+			+			
	Agyneta cauta (O. P.-Cambridge)	Nr							+
	Agyneta ramosa Jackson	Local	+						+
	Meioneta innotabilis (O. P.-Cambridge)	Nr				+			
	Meioneta rurestris (C. L. Koch)	Common	+						+
	Meioneta saxatilis (Blackwall) †	Common	+	+					+
	Microneta viaria (Blackwall)	Common	+		+	+	+		+
	Centromerus sylvaticus (Blackwall)	Common							+
	Tallusia experta (O. P.-Cambridge)	Common	+		+				+
	Centromerita bicolor (Blackwall)	Common							+

Family	Species	Status	1	2	3	4	5	6	Smith
Linyphiidae	*Centromerita concinna* (Thorell)	Common							+
	Saaristoa abnormis (Blackwall)	Common					+		
	Bathyphantes approximatus (O. P.-Cambridge)	Common		+	+		+		+
	Bathyphantes gracilis (Blackwall) †	Common	+	+	+		+	+	+
	Bathyphantes parvulus (Westring) †	Common		+	+	+	+		+
	Bathyphantes nigrinus (Westring)	Common					+		+
	Bathyphantes setiger (O. P.-Cambridge)	Local	+						
	Kaestneria dorsalis (Wider)	Common					+		+
	Kaestneria pullata (O. P.-Cambridge)	Common						+	+
	Diplostlya concolor (Wider)	Common		+	+	+			+
	Poeciloneta variegata (Blackwall)	Common			+				+
	Drapetisca socialis (Sundervall)	Common							+
	Floronia bucculenta (Clerck)	Local							+
	Taranucnus setosus (O. P.-Cambridge)	Local	+						+
	Lepthyphantes leprosus (Ohlert)	Common					+		
	Lepthyphantes minutus (Blackwall)	Common							+
	Lepthyphantes alacris (Blackwall)	Common				+	+		+
	Lepthyphantes obscurus (Blackwall)	Common		+	+	+	+		+
	Lepthyphantes tenuis (Blackwall) †	Common	+	+	+	+			+
	Lepthyphantes zimmermanni Bertkau	Common	+	+	+	+	+		+
	Lepthyphantes cristatus (Menge) †	Common							+
	Lepthyphantes mengei Kulczynski †	Common			+	+	+		+
	Lepthyphantes flavipes (Blackwall)	Common	+		+	+	+		
	Lepthyphantes tenebricola (Wider)	Common							+
	Lepthyphantes ericaeus (Blackwall) †	Common	+	+			+	+	+
	Lepthyphantes pallidus (O. P.-Cambridge)	Common	+	+	+		+		+
	Helophora insignis (Blackwall)	Common							(+)
	Linyphia triangularis (Clerck)	Common							+
	Linyphia hortensis Sundervall	Common				+			+
	Neriene montana (Clerck)	Common		+	+				+
	Neriene clathrata (Sundervall)	Common	+	+	+		+	+	+
	Neriene peltata (Wider)	Common		+	+	+	+		+
	Microlinyphia pusilla (Sundervall) †	Common		+					+
	Microlinyphia impigra (O. P.-Cambridge)	Local							+
	Allomengea vidua (Koch)	Local							+
Tetragnathidae	*Tetragnatha extensa* (Linnaeus)	Common	+	+				+	+
	Tetragnatha montana Clerck	Common	+	+	+	+	+	+	+
	Tetragnatha obtusa C. L. Koch	Local				+			+
	Pachygnatha clercki Sundevall †	Common	+	+	+	+			+
	Pachygnatha degeeri Sundevall †	Common	+						+
	Metellina segmentata (Clerck)	Common							+
	Metellina mengi (Blackwall)	Common	+	+	+	+	+	+	+
	Metellina merianae (Scopoli)	Common							+
Araneidae	*Araneus diadematus* Clerck	Common	+						+
	Araneus quadratus Clerck	Common							+

Family	Species	Status	1	2	3	4	5	6	Smith
Araneidae	*Araneus marmoreus* Clerck † ***	Local							+
	Larinioides cornutus (Clerck)	Common	+						
	Nuctenea umbratica (Clerck)	Common							+
	Araniella curcurbitina (Clerck)	Common		+			+		+
	Araniella opistographica (Kulczynski)	Local	+						+
	Zygiella x-notata (Clerck)	Common							+
	Zygiella atrica (C. L. Koch)	Common							+
	Hypsosinga pygmaea (Sundevall) †	Local		+				+	
	Cyclosa conica (Pallas)	Local							+
Lycosidae	*Pardosa pullata* (Clerck) †	Common	+	+					+
	Pardosa prativaga (L. Koch)	Local	+						
	Pardosa amentata (Clerck)	Common	+	+			+		+
	Pardosa nigriceps (Thorell) †	Common							+
	Alopecosa pulverulenta (Clerck) †	Common							+
	Trochosa ruricola (Degeer)	Common							+
	Trochosa terricola Thorell †	Common							+
	Pirata piraticus (Clerck)	Common	+					+	+
	Pirata hygrophilus Thorell	Local	+	+	+	+	+	+	+
Cybaeidae	***Argyroneta aquatica*** (Clerck)	Local							(+)
Hahniidae	***Antistea elegans*** (Blackwall)	Common							+
	Hahnia montana (Blackwall) †	Common							+
Dictynidae	*Dictyna arundinacea* (Linnaeus) †	Common	+	+					+
	Dictyna uncinata Thorell *	Common		+					+
	Lathys humilis (Blackwall)	Local			+				
Clubionidae	*Clubiona reclusa* O. P.-Cambridge †	Common	+	+				+	+
	Clubiona stagnatilis Kulczynski	Local	+	+				+	+
	Clubiona pallidula (Clerck)	Local						+	
	Clubiona phragmites C. L. Koch	Common	+						+
	Clubiona comta C. L. Koch	Common				+			
	Clubiona lutescens Westring	Common	+	+		+	+		+
	Clubiona brevipes Blackwall	Local		+					+
Zoridae	*Zora spinimana* (Sundevall) †	Common					+		+
Philodromidae	*Philodromus dispar* Walckenaer	Local			+	+			
	Philodromus aureolus (Clerck)	Common		+			+		+
	Philodromus cespitum (Walckenaer)	Common		+					
	Tibellus maritimus (Menge) †	Local							+
	Tibellus oblongus (Walckenaer)	Common	+					+	+
Thomisidae	*Xysticus cristatus* (Clerck)	Common	+	+					+
	Xysticus lanio C. L. Koch	Local							+
	Xysticus ulmi (Hahn)	Local	+				+		+
	Ozyptila praticola (C. L. Koch)	Nr							(+)
	Ozyptila trux (Blackwall) †	Local	+				+		+

Family	Species	Status	1	2	3	4	5	6	Smith
Salticidae	*Salticus scenicus* (Clerck)	Common							+
	Salticus cingulatus (Panzer)	Local		+					+
	Neon reticulatus (Blackwall) †	Common							+
	Euophrys frontalis (Walckenaer)	Common					+		+

Taxa are ordered according to the Merrett & Murphy (2000) checklist.

(+) Species not found since 1960.

* Found on the path to Site 1.

** Immature, but a new genus to Askham Bog in recent times [Martin Lister recorded *A. lunata* in 1678].

*** Both colour morphs, *pyramidatus* and the rarer *marmoreus*, are present on the Reserve.

† Species regarded as 'appropriate' to the bog habitat (see text).

‡ Species names in bold are considered to be wetland indicators.

Note: *Walckenaera kochi* was recorded by Smith (1962) but omitted from his checklist in Fitter & Smith (1979). *Maso sundervalli* was not recorded in either publication but is mentioned in an unpublished notebook.

lividus and *Bathyphantes approximatus* at Site 5).

It is interesting to compare Smith's species list with that from the present survey. Smith collected from Askham Bog during the period 1958 to 1962 (Smith, 1962). From a notebook, started in February 1960, it is clear that he sampled approximately monthly (two to three times a month during autumn) at least from then through to November 1961, and more sporadically after that. His intensity of sampling prior to 1960 is not known. Given that Smith's checklist was accumulated over a period of at least five years, and that the present survey was conducted on one day, it is not surprising that 56 species mentioned by Smith were not identified by us (Table 3). At least some of these species mature in late summer or autumn, e.g. *Metellina segmentata*, *Lepthyphantes minutus* and *Walckenaera kochi*, and would be expected to be missed (or unidentifiable) in late May. A good proportion of the 56 species are generally uncommon (Smith, 1962). They may also be spatially aggregated, and would very likely be missed in a snapshot survey. Other species on Smith's list were recorded prior to 1960 and have not been found since e.g. *Argyroneta aquatica*. This species in particular may have thrived in the old brick ponds in the eastern section of the Bog that was reclaimed in the 1950s (see above). However, to find this spider requires the use of techniques not deployed in the present survey, and possibly not by Smith either. Until these techniques are used, the status of *A. aquatica* on Askham Bog remains unknown.

Some species were found in 1999 that were not recorded by Smith, despite his intensive sampling (Table 3). Eighteen out of the 24 species in this category (75%) were recorded in just one of the six sites sampled. Only six of the 24 came from the area of Askham Bog Smith appeared to sample the most (Site 1 – the clearing in Near Wood) and so his relative lack of attention to other habitats within the Bog may account for the majority of the unrecorded species. However, even at Site 1 some of the species recorded in 1999 for the first time are surprising. For example, *Larinioides cornutus* is a highly visible species that surely would not have been missed had it been present during Smith's survey. Likewise, *Lepthyphantes flavipes* was not recorded by Smith yet it was found at four out of the six sites examined in 1999, including Site 1. His notebook contains no reference to this species so the conclusion must be either that it has increased in numbers in the almost 30 years between the two surveys, or that it was mistaken for something else.

Table 2 records the distributional/rarity status of all species found at Askham Bog. These have been determined from the catagorization in Harvey *et al.* (2002), but with appropriate adjustments for species towards the edges of their distributions in Yorkshire. Of course, the

TABLE 3.
Species that were not common between the two surveys

Found by Smith, but not in 1999

Ero furcata (Villers)
Steatoda bipunctata (Linnaeus) *
Theridion impressum (L. Koch)
Theridion mystaceum L. Koch
Robertus arundineti (O. P.-Cambridge)
Pholcomma gibbum (Westring)
Ceratinella brevipes (Westring)
Ceratinella brevis (Wider)
Walckenaera acuminata Blackwall
Walckenaera nudipalpis (Westring)
Entelecara omissa (O. P.-Cambridge)
Gnathonarium dentatum (Wider)
Baryphyma pratensis (Blackwall)
Oedothorax fuscus (Blackwall)
Oedothorax retusus (Westring)
Pelecopsis parallela (Wider)
Tiso vagans (Blackwall)
Monocephalus fuscipes (Blackwall)
Araeoncus humilis (Blackwall)
Erigone arctica (White)
Drepanotylus uncatus (O. P.-Cambridge)
Ostearius melanopygius (Blackwall)
Porrhomma convexum (Westring)
Agyneta cauta (O. P.-Cambridge)
Centromerus sylvaticus (Blackwall)
Centromerita bicolor (Blackwall)
Centromerita concinna (Thorell)
Drapetisca socialis (Sundervall)
Floronia bucculenta (Clerck)
Lepthyphantes minutus (Blackwall)
Lepthyphantes cristatus (Menge)
Lepthyphantes tenebricola (Wider)
Helophora insignis (Blackwall) *
Linyphia triangularis (Clerck)
Microlinyphia impigra (O. P.-Cambridge)
Allomengea vidua (O. P.-Cambridge)
Metellina segmentata (Clerck)
Metellina merianae (Scopoli)
Araneus quadratus Clerck
Araneus marmoreus Clerck
Nuctenea umbratica (Clerck)
Zygiella x-notata (Clerck)
Zygiella atrica (C. L. Koch)
Cyclosa conica (Pallas)
Pardosa nigriceps (Thorell)
Alopecosa pulverulenta (Clerck)
Trochosa ruricola (Degeer)
Trochosa terricola Thorell
Argyroneta aquatica (Clerck) *
Antistea elegans (Blackwall)
Hahnia montana (Blackwall)
Tibellus maritimus (Menge)
Xysticus lanio C. L. Koch
Ozyptila praticola (C. L. Koch) *
Salticus scenicus (Clerck)
Neon reticulatus (Blackwall)

Found in 1999, but not by Smith

Achaearanea sp.
Theridion tinctum (Walckenaer)
Robertus neglectus (O. P.-Cambridge)
Ceratinella scabrosa (O. P.-Cambridge)
Walckenaera atrotibialis (O. P.-Cambridge)
Walckenaera furcillata (Menge)
Silometopus reussi (Thorell)
Cnephalocotes obscurus (Blackwall)
Erigone promiscua (O. P.-Cambridge)
Erigone longipalpis (Sundevall)
Porrhomma oblitum (O. P.-Cambridge)
Meioneta innotabilis (O. P.-Cambridge)
Saaristoa abnormis (Blackwall)
Bathyphantes setiger (O. P.-Cambridge)
Lepthyphantes leprosus (Ohlert)
Lepthyphantes flavipes (Blackwall)
Larinioides cornutus (Clerck)
Hypsosinga pygmaea (Sundevall)
Pardosa prativaga (L. Koch)
Lathys humilis (Blackwall)
Clubiona pallidula (Clerck)
Clubiona comta C. L. Koch
Philodromus dispar Walckenaer
Philodromus cespitum (Walckenaer)

* Species not recorded since 1960

classification of species as 'common', 'local' or Nr (regionally notable) must to some extent be arbitrary. Ball (1992) devised a weighting scheme (Species Quality Index, SQI) based on distributional/rarity categories in order to quantify the value of a site from the point of view of its conservation value. The weights assigned (following Foster, 1987) were: 32 points for an RDB species, 16 for Na, 8 for Nb, 4 for Nr, 2 for local and 1 for common. The cumulative weight is then divided by the number of species to give a mean score per species. The mean SQI for Askham Bog spiders is exactly 1.5. Ball (1992) calculated SQIs for various communities on Thorne and Hatfield Moors using Auchenorhyncha (Hemiptera: Homoptera) and Carabidae (Coleoptera) caught in pitfall traps. For his fen communities, the nearest to Askham Bog, the average SQI was close to 1.5. A number of studies, specifically targeting spiders, have also used the SQI scoring method. Nellist (1994) co-ordinated a survey of Orford Ness, a shingle bank off the Suffolk coast, and calculated a SQI of 3.6. Similarly, Shardlow's (1998) work on Havergate Island, a NNR also in Suffolk, yielded a SQI across the whole site of 3.4. Both of these values are clearly far higher than that derived from Askham Bog, but they were for rather different habitat types. Scott (2001) calculated SQIs for spiders from 32 bogs in northern England and Wales and found values between 1.8 and 3.0, again higher than at Askham Bog although his rarity catagories were based on presence and absence in Watsonian vice-counties. However, applying his catagorization to Askham Bog spiders yields a SQI of 1.46, very close to the 1.5 calculated here, so comparisons with his results are probably valid.

Species found at Askham Bog can be divided into wetland indicator species, other species that are appropriate to the habitat (i.e. species that can complete their life cycles there) and inappropriate species (i.e. those normally associated with other habitats that may have accidentally dispersed into the site) (Scott, 2001; Relys *et al.*, 2002). A second index of the conservation value for the site is therefore the proportion of wetland indicator species. Of the 176 species recorded across both surveys, 27 are considered to be wetland indicators (15.3%), and are shown in bold in Table 2. Smith recorded all but one of them whereas in the present survey only 17 were found. Some of this deficit will almost certainly be a result of sampling at just one time of year when many of the linyphiids, in particular, are immature. Scott's analysis of data from Welsh mires (Scott, 2001) has shown that the number of wetland spider indicator species present, although not themselves necessarily rare, is rather strongly correlated with the number of rarities present in other invertebrate groups. The number from Askham Bog is towards the upper end of the range encompassed by the Welsh mires and, if the calibration holds, suggests that the Reserve should house *c.* 30 RDB or Notable invertebrate species other than spiders. The numbers of wetland indicator species/total species for the individual stations sampled in the current survey were 12/57 (21.0%, Site 1), 5/55 (9.1%, Site 2), 7/47 (14.9%, Site 3), 3/40 (7.5%, Site 4), 4/45 (8.9%, Site 5) and 6/23 (23.3%, Site 6). These figures reflect rather well the perceived wetness of the different sample sites, with sites 1 and 6 the wettest.

A final indication of the 'naturalness' of a site is the proportion of species that are wetland indicators or which are appropriate to a wetland habitat (Ball, 1992). Appropriate species are indicated in Table 2 with a †, and are broadly those used by Scott (2001). The total proportion of indicator and appropriate species across both surveys is (27+36) / 175 i.e. 0.36. This is rather low in comparison to the sites investigated by Scott (2001). There his least disturbed sites had 'naturalness' values in excess of 0.5. A possible reason for the low value calculated for Askham Bog is discussed below.

Discussion

The data gathered by Smith were amassed through all seasons and over a number of years, whereas the present survey was conducted on just one day in late May. Consequently, it could be argued that the two surveys are not comparable. However, there are compensatory factors that may make the second survey more representative than it might seem. The end of May falls right in the middle of the two-month period identified by Scott (2001) during which the number of species, and the number of individuals, peak. The survey took place on a warm, dry day when spiders are likely to be most active, and a wide variety of capture techniques were employed. Finally, the presence of nine participants equates, effectively, to nine person-days of effort and

may have cancelled out any individual collecting bias. The fact that 25 new spider species were recorded at Askham Bog after the one-day survey indicates that the list for the Reserve is far from complete. More detailed examination of the whole Bog, and at different times of year, would be expected to increase the total substantially. Some of the arguments made here combine data from the two surveys as if they were contemporary. This may be dangerous if the nature of the Bog, and its arachnofauna, have changed significantly over the intervening 40 years.

Given the fact that Askham Bog represents a rather rare habitat in northern England, and considering its past recognition as a centre of diversity for a number of different taxa (Fitter & Smith, 1979), the SQI generated from the spider data seems surprisingly low. Without detailed surveys prior to that of Smith, it is impossible to judge whether the low SQI reflects a lowering of habitat quality or whether this type of habitat in the north has never contained the spider rarities (with the exception of *Entelecara omissa* and *Porrhomma oblitum*) required to produce a very high SQI score. Scott (2001) suggests the latter explanation may be the most likely. SQI scoring based on spiders may not, therefore, be the most appropriate measure of conservation value for a wetland site in northern England.

Despite an apparent lack of 'excellence' on the SQI scale, Askham Bog does contain a suite of spider species that can be considered wetland indicators. To find 27 of these is remarkable. Scott's (2001) work in Cheshire provides a useful comparison. His derived relationship of counts of indicator spider species over a single year on areas of active peat-forming vegetation suggests that 27 indicator species would be expected on a bog of some 150 hectares, three times the total area of Askham Bog. Although this calibration was made on the basis of a somewhat different sampling regimes it does, nonetheless, suggest that Askham Bog may have a much higher diversity of wetland indicator species for its area than might be expected. As a result of the encroachment of trees, many areas of the Reserve are now relatively dry, making the number of wetland indicator species even more surprising. One partial explanation may be that the high number of these species reflects a time when the area of the bog that was true wetland was greater, and that it is not currently at equilibrium with respect to Scott's (2001) species-area relationship. Alternatively, Askham Bog may contain a heterogeneous suite of wetland habitats which accommodates more indicator species than the species-area model would predict. Current management of the Reserve aims to reduce the woodland cover and increase the area of wet bog. These wetland indicator species will act as a vital reservoir for the future colonisation of reclaimed areas.

As argued above, this indicator-species community is important not so much in itself, for most of the species are relatively common, but for what it may indicate about the likelihood of rarities in other invertebrate taxa. As already mentioned, if the relationship derived by Scott (2001) between spider indicator species and RDB and Notable species in other invertebrate groups is valid for Askham Bog, it suggests that there should be roughly 30 or so of the latter on the Reserve. The YWT holds an Invertebrate Site Register (1998) for Askham Bog and also lists of species either not incorporated into the Register or discovered/rediscovered subsequent to 1998. The total number of RDB and Notable invertebrate species found on the Reserve since 1960 is 60, twice that predicted. At first sight it suggests that Scott's (2001) calibration does not hold for Askham Bog. There may be many reasons for this including different climatic conditions between east and west (for example in rainfall), different patterns of historical colonisation and different habitat diversities between sites used in the calibration and that of Askham Bog. However, there are additional variables that underlie Scott's (2001) calibration, for example recording effort and survey methods for taxa other than spiders. The high number of RDB and Notable invertebrate species recorded at Askham Bog could reflect its reputation as a source of unusual species and, as a result, it may have received more recorder effort than the average mire considered by Scott. In addition, differences in sampling techniques will affect the groups of invertebrates recorded. Pitfall trapping, for example, will not effectively sample families such as Hymenoptera, Diptera and Lepidoptera. The number of rare species at Askham Bog quoted above was accumulated over forty years or so (to correspond to the arachnological data), whereas those of sites used in the Welsh Peatland Invertebrate Survey, and on which Scott (2001) based his conclusions, were gathered over five months within a single year. If the

techniques and methodologies of the Welsh Peatland Invertebrate Survey had been applied at Askham Bog a closer fit to prediction might have been achieved.

The 'naturalness' of Askham Bog's arachnofauna is rather low in comparison with other bogs in the northwest of England and Wales. The high number of 'inappropriate' species may be a function of the encroachment of trees and the drying out of the bog surface, a matter that should be rectified by current management strategies. At the interface between open bog and taller vegetation, competitively superior, non-bog specialists may invade the bog surface and replace the true wetland spider species, and so edges between these habitats need to be minimised. Enrichment of 'inappropriate' species in this survey may also, in part, represent an artifact of sampling. In the 1999 survey, and possibly in Smith's too, spiders were deliberately sampled from trees and shrubs as well as in and on bog vegetation in order to catalogue fully the species present. In contrast, Scott's surveys were concerned solely with the ground layer.

Despite these reservations, the two surveys of Askham Bog's arachnofauna considered here suggest that specialist bog species are continuing to thrive despite a general drying out of the bog habitat. These should act as a reservoir for the recolonisation of wet areas recreated by current management strategies. Scott's (2001) calibration, on the basis of the number of wetland indicator spider species, suggests the Reserve should hold *c.* 30 RDB or Notable species in other invertebrate groups; in fact, the number recorded since 1960 is double this. Despite real difficulties in interpreting this discrepancy, as discussed above, the indications are that Askham Bog is still an extremely important reserve in the region, at least from the point of view of invertebrate conservation.

Acknowledgements

We would like to record our grateful thanks to Maxine Curzon, Tom Faulds, Trevor Harris, Stephen Hartley, Simon Jackson, Nick Loven and Howard Williams for assisting with this survey. Special thanks must go to Tom Faulds and Trevor Harris who kindly identified specimens others did not have the time or expertise to deal with. Julian Small (YWT) helped with the logistics of the day, suggested suitable sites to sample and provided botanical details of the sites chosen. Other invertebrate groups in pitfall samples were kindly identified by Mike Denton (Coleoptera), Doug Richardson (Isopoda, Chilopoda and Diplopoda) and Roy Crossley (Diptera). We are indebted to Robert Masheder (YWT) for providing the lists of RDB and Notable species recorded at Askham Bog, and for commenting on a draft of the paper. Alastair Fitter and William Sessions (Ebor Press) gave permission for the reproduction of Figure 1. We dedicate this paper to the memory of Clifford Smith, who did so much to further our understanding of the distributions of spider species in Yorkshire and beyond.

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APPENDIX 1.
Species lists for invertebrate families other than spiders.

Coleoptera **Species**	**Status**	**Near Wood**	**Middle Wood**	**Far Wood**
Nebria brevicollis (F., 1792)	Common		+	
Elaphrus cupreus Duftschmid, 1812	Common			+
Pterostichus diligens (Sturm, 1824)	Common	+		+
Pterostichus minor (Gyllenhal, 1827)	Local	+	+	+
Pterostichus niger (Shaller, 1783)	Common		+	
Pterostichus nigrita (Paykull, 1790)	Common	+	+	+
Pterostichus strenuus (Panzer, 1796)	Common	+	+	+
Helophorus minutus F., 1775	Common	+		
Agonum albipes (F., 1796)	Common			+
Agonum fuliginosum (Panzer, 1809)	Common		+	+
Agonum obscurum (Herbst, 1784)	Local		+	
Hydroporus angustatus Sturm, 1835	Common		+	
Cercyon tristis (Illiger,1801)	Nb	+	+	
Megasternum obscurum (Marsham, 1802)	Common	+	+	+
Scydmaenus tarsatus Mueller & Kunze, 1822	Local	+		+
Stenus boops Ljungh, 1810	Common	+		
Philonthus varians (Paykull, 1789)	Common	+		
Quedius maurorufus (Gravenhorst, 1806)	Common	+		
Galerucella tenella (L., 1761)	Common	+		
Lochmaea caprea (L., 1758)	Common	+		
Anacaena globulus (Paykull, 1798)	Common		+	+
Nargus velox (Spence, 1813)	Common		+	+
Anotylus rugosus (F., 1775)	Common		+	
Lathrobium brunnipes (F., 1792)	Common		+	
Lesteva heeri Fauvel, 1872	Common			+
Anotylus rugosus (F., 1775)	Common			+
Habrocerus capillaricornis (Gravenhorst, 1806)	Local			+
Quedius curtipennis Bernhauer, 1908	Common		+	+
Atheta fungi (Gravenhorst, 1806)	Common			+
Atheta pertyi (Heer, 1839)	Local		+	
Oxypoda elongatula Aube, 1850	Common			+

Determiner: Mike Denton.

Isopoda, Chilopoda, Diplopoda

Species	Site 1	2	3	4	5
Isopoda					
Oniscus asellus Linnaeus			1M	4M	2M
Philoscia muscorum (Scop.)	8M	1M			
Porcellio scaber Latrielle	1F				1F
Chilopoda					
Lithobius forficatus Linnaeus					1F
Diplopoda					
Craspedosoma rawlinsii Leach					1F
Cylindroiulus britannicus (Verhoeff)	1M				
Cylindroiulus punctatus (Leach)				1F	
Julus scandinavius Latzel				5M	
Ophyiulus pilosus (Newport)	1F	1M	1M		
Polydesmus angustus Latzel	1F	1F		15M, 8F	8M, 8F

Determiner: Douglas T. Richardson. M = male, F = female

Diptera

Site 1: *Platypalpus longicornis* (Hybotidae)
Site 2: *Limonia tripunctata* (Limoniidae)
Site 3: *Rhamphomyia crassirostris* (Empididae)
Site 5: *Beris chalybata* (Stratiomyidae)

Determiner: Roy Crossley.

BOOK REVIEW

The Correspondence of Charles Darwin: Volume 13, 1865 edited by **Frederick Burkhardt** and others. Pp. xc + 695 (including several line drawings), plus 9 pp. of b/w plates. Cambridge University Press, Cambridge. 2002. £65.00 hardback.

The latest volume in this remarkable series is devoted to the period when Darwin was preoccupied with the writing of *The Variation of Animals and Plants under Domestication*, a work commenced soon after the publication of *Origin of Species* that was intended to elaborate his major theories. Unfortunately, due to illness, he had to abandon his plans to publish this work in 1865 (it was eventually published in 1868). The material he was assembling would prove to be the forerunner of modern genetic theory, but even when Darwin was well he found difficulty in concentrating on this due to the many other projects he was involved in, particularly his work on climbing plants, and the demands on his time through correspondence with many leading scientists such as Asa Gray, Joseph Hooker, Thomas Huxley, John Lubbock, Charles Lyell and Alfred Wallace. Of particular interest is Darwin's adjudication of a dispute between Lyell and Lubbock over whether Lyell in his *Antiquity of Man* had properly acknowledged the other's work; this dispute arose as a consequence of Lubbock's book *Prehistoric Times*, published in 1865, in which he accused Lyell of plagiarism. As well as the correspondence, with detailed textual apparatus, the

volume contains translations of foreign letters, a note on Darwin's health, information on sources and provenances, an extensive biographical register, a bibliography and a comprehensive index. The volume also includes a 126-page Supplement to the Correspondence 1822-1864 of 104 letters. This monumental undertaking just goes from strength to strength (Naturalist, passim) – what more can one say?

MRDS

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IRISH NATURALISTS' JOURNAL

The *Irish Naturalists' Journal,* sucessor to the *Irish Naturalist, c*ommenced publication in 1925. The quarterly issues publish papers on all aspects of Irish natural history, including botany, ecology, geography, geology and zoology. The *Journal* also publishes distribution records, principally for cetaceans, fish, insects and plants, together with short notes and book reviews.

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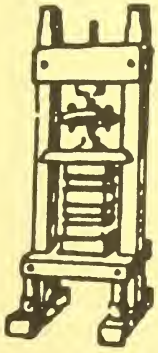

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January-March 2004

Number 1048
Volume 129

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To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record his deep appreciation of this imaginative gesture.

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Volume 129
2004

Published by the Yorkshire Naturalists' Union

BUTTERFLIES OF MALHAM TARN: FIFTY YEARS OF CHANGE

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Introduction

On preparing a presentation on the butterflies of Malham Tarn for the 3rd Malham Tarn Research Symposium 'Living in a Limestone Landscape', November 2003, it was found that the butterfly fauna had changed markedly since 1954-1958. This was when the first comprehensive study on the insects of the Malham Tarn area was made by the Entomological Section of the Yorkshire Naturalists' Union and produced a catalogue of the Lepidoptera in the area (YNU 1963). Although this study gives a list of only eight species of resident butterfly (plus two common migrants) it is a benchmark of lepidopteran occurrence in the Yorkshire Dales National Park as there is little information about the occurrence of most butterflies in western Yorkshire until comparatively recently (Whitaker 2004b).

Throughout the North of England there has been an expansion of many species of butterfly from the middle of last century (Asher *et al.* 2001). These are not simply autecological changes of a few species, but as Barnham and Foggitt's (1993) investigation around Harrogate and Fryer and Lucas (2001) in a comprehensive study of the butterfly fauna of the Huddersfield area illustrated, the whole butterfly fauna of many places has changed markedly in the last half century and is still changing at a very rapid pace.

Recent records in grid squares SD86 and SC87

The traditional recording area around Malham Tarn is about 1 square mile (260 Ha) and involves parts of six 1 km grid squares, (SD8866, 8867, 8965, 8966, 8967, 9066). The Tarn occupies more than a quarter of the area. Collation of records, 1967-1982, by John Heath at the Biological Records Centre, Monkswood, culminated in the publication of the first national distribution maps. Green Hairstreak (*Callophrys rubi*) and Northern Brown Argus (*Aricia artaxerxes*), two species not recorded by the YNU, were recorded in the two 10 km map squares that include Malham Tarn but these records were not from the Malham 1 km squares (Heath 1982, Emmett & Heath 1989). Records selected from within these grid-squares for the period 1999-2003, in the Butterfly Conservation dataset (Asher *et al.* 2001, and update) produced a list comprising 17 resident, two migrant and two vagrant species (Table 1).

Species not recorded in the YNU study

For a variety of reasons the YNU study did not record the three habitat specialist species currently confirmed at Malham. These are now all 'species of conservation concern'. The Northern Brown Argus an internationally important species and a UK BAP priority species, is classed by Butterfly Conservation as being of high national and regional (North-east England) priority. The Dark Green Fritillary (*Argynnis aglaja*) and the Green Hairstreak are identified as being of low priority nationally but of medium priority regionally (Ellis 1999) but their national status is currently undergoing a reappraisal. (Fox *et al.* 2001).

The Green Hairstreak, dependent on the Bilberry (*Vaccinium myrtillus*), found on the peaty banks of the inflow stream at the north-eastern edge of Tarn Moss, has other of its complex habitat needs fulfilled by the nearby Tarn Fen. These requirements are nectar plants and a warm sunny microclimate early in the season. The males also need vantage points in small trees to establish a territory. Between 1999 and 2003 the extreme flight dates of the species were April 6-June 7 (Figure 1). As the YNU visited between 12 June and 16 September 1954-1958 (Michaelis 1963), it is not surprising that the species was missed. There are suggestions that the Green Hairstreak has spread in Yorkshire in the last

TABLE 1
Butterflies at Malham Tarn, 1950-8 and 1999-2003

BUTTERFLY SPECIES	TYPE OF BUTTERFLY	1950-1958	1999-2003	LOCATIONS After Sinker (1960)	ABUNDANCE 1999-2003		FIRST REPORT
Peacock	Wider Countryside	Present	Present	**W**, TF, TC	651	22.5%	1948
Green-veined White	Wider Countryside	Present	Present	**TF, TM, HM,** W, HMP	539	18.7%	1948
Small Tortoiseshell	Wider Countryside	Present	Present	**W**, TF, TC,	470	16.3%	1948
Red Admiral	Common Migrant	**Migrant**	**Migrant**		315	10.9%	*pre* 1950
Common Blue	Wider Countryside	Present	Present	**HF**, TF, TC	217	7.5%	1948
Painted Lady	Common Migrant	**Migrant**	**Migrant**		208	7.2%	*pre* 1950
Green Hairstreak	**Habitat Specialist**	**—***	Present	**TM, TF**	135	4.7%	—
Small Heath	Wider Countryside	Present	Present	**HF**, ML	135	4.7%	1948
Meadow Brown	Wider Countryside	Absent	Present	**HF, TC**, TF, HM	74	2.6%	1999
Large White	Wider Countryside	Present	Present	**G**	43	1.5%	1948
Northern Brown Argus	**Habitat Specialist**	**—***	Present	**HF**	40	1.4%	—
Comma	Wider Countryside	Absent	Present	**TF**, W, TC, TM	13	0.5%	*ca* 1995
Small Skipper	Wider Countryside	Absent	Present	**HF**, TC,	12	0.4%	2002
Small White	Wider Countryside	Present	Present	**G**	12	0.4%	*pre* 1950
Dark Green Fritillary	**Habitat Specialist**	**1-**1950*	Present	**HF,** TC, HMP, HM	7	0.2%	1950
Large Skipper	Wider Countryside	Absent?	Present	**HF, TF**, TC	6	0.2%	*pre* 1996?
Orange Tip	Wider Countryside	Absent	Present	**TF**	4	0.1%	*ca* 1996
Small Copper	Wider Countryside	Absent?	Present	**TM**	3	0.1%	*pre* 1997
Ringlet	Wider Countryside	Absent	Vagrant?	TC, TF	2	0.1%	2003?
Brimstone	Wider Countryside	Absent	Vagrant	TF	1	<0.1%	Not Resident
Gatekeeper	Wider Countryside	Absent	Vagrant	TF	1	<0.1%	Not Resident
Holly Blue	Wider Countryside	Present	**Absent**	Woodland Edges	Absent	—	1948
	TOTAL SPECIES	**13?**	**21**		**n = 2888**		

KEY: Ha Mire (HM), Ha Mire Plantation (HMP), High Folds Scar (HF), Malham Lings (ML), Tarn Close (TC), Tarn Fen (TF), Tarn Moss (TM), Gardens (G), Widespread (W), * Not recorded by YNU, Bold type locations indicates main habitat.

50 years ,associated with increased upland grazing by sheep favouring Bilberry over Heather (*Calluna vulgaris*) but as both plant species are very intolerant of heavy grazing this seems unlikely. On Tarn Moss grazing has been minimal since 1948, although burning for grouse habitat was reduced (Sinker 1960).

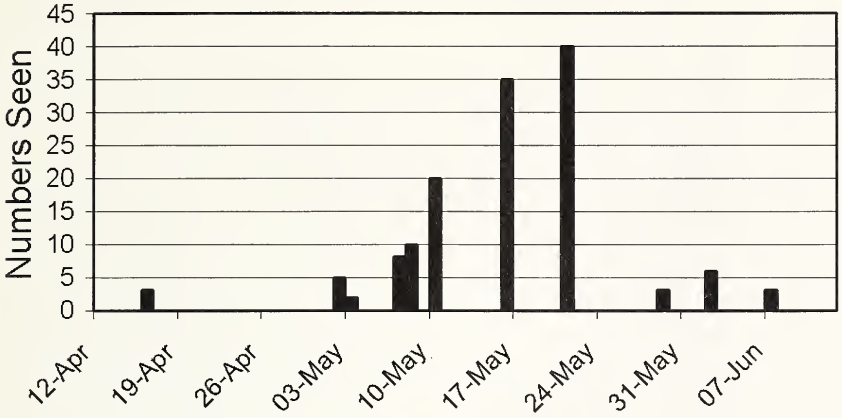

FIGURE 1
Green Hairstreak (*Callophrys rubi*) flight period at Malham Tarn, 1999-2003.

The Dark Green Fritillary is now a very local species in western Yorkshire. It is usually present in low numbers and rarely seen except as solitary individuals. It is a large butterfly and a powerful flyer, more often seen at nectar than near its larval food-plants (*Viola* spp.) (Whitaker 2004b). It is easily overlooked unless repeated visits are made to suitable nectaring sites. Individual small colonies may not persist and whilst it may not have been on High Fold Scar during the YNU survey it was probably present locally. A card in the file held at the FSC Malham Tarn Field Centre reads 'Dark Green Fritillary, Upper Gordale above Mastiles Bridge 19/8/1950'. The Northern Brown Argus is another very local butterfly, rarely found far from its foodplant Common Rock Rose (*Helianthemum nummularium*). It can be locally common but its small size, rapid flight and silvery appearance in flight can conceal its true identity from all but the experienced observer. It is totally inactive in poor weather and although it is possible to find the adults roosting on grass stems in sheltered downslope areas, the distinctive white eggs, on the upper sides of Rock Rose leaves, are the easiest way to confirm its presence. It is unsurprising that it was not noticed on High Folds Scar.

The abundance of resident butterflies

Ignoring regular migrants, present in variable numbers from year to year but unable to survive the northern winter, the six commonest butterflies at Malham Tarn (1999-2003) were Peacock (*Inachis io*), Green-veined White (*Pieris napi*), Small Tortoiseshell (*Aglais urticae*), Common Blue (*Polyommatus icarus*), Green Hairstreak (*Callophrys rubi*) and Small Heath (*Coenonympha pamphilus*), in that order. (Table 1, Figure 2).

In the YNU study the only species that was common was the Green-veined White, though the Small Heath was described as being 'widespread' on Fountains Fell. Both the Peacock, Small Tortoishell and the Common Blue were classed as 'occasional' (Michaelis 1963), but in the FSC card files there are additional records: 'Small Tortoishell, Spring 1948, many hibernating in Tarn House', '10-17 July 1948 larvae abundant from Malham Village to Fountains Fell'. These records suggest that it was periodically common over 50

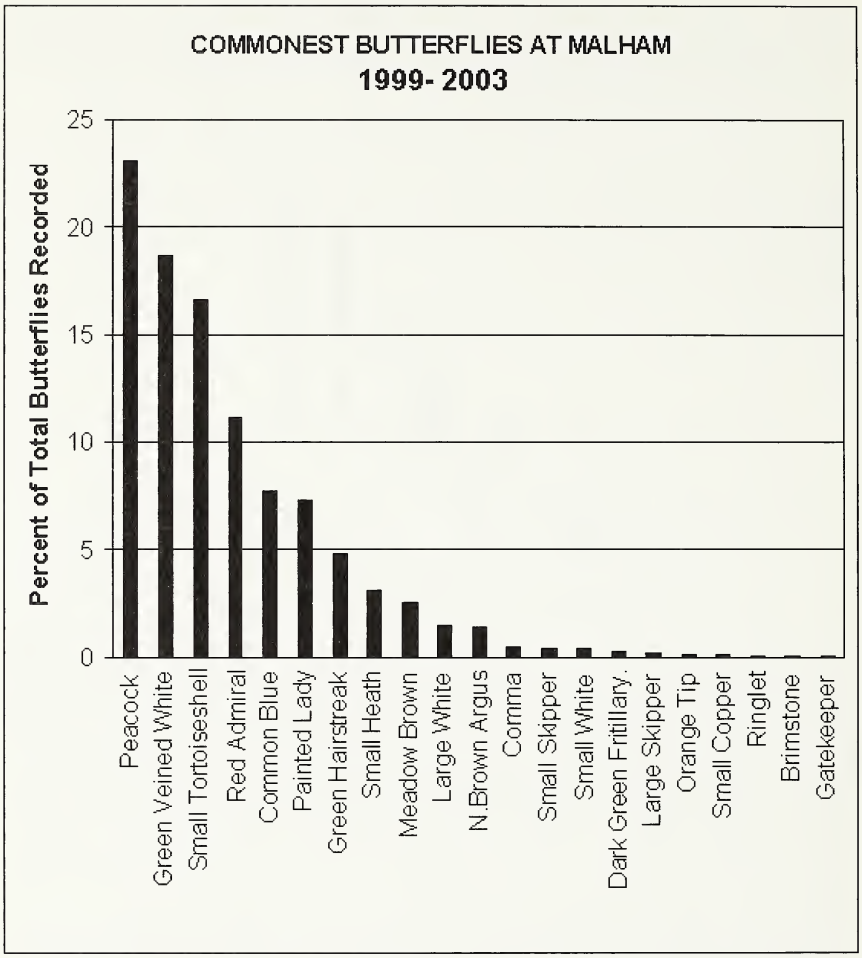

FIGURE 2
Relative abundance of 21 species of butterfly seen at Malham Tarn 1999-2003.

years ago. The Peacock was absent as a breeding species from most of the Pennines before 1982 (Asher 2001), but as it is highly mobile it would periodically re-establish. There are several references to single adults in the record cards 1949-50 but larvae were only reported in 1948. Since about 1980 there has been a major increase in the abundance of the Peacock in the Yorkshire Dales and at Malham Tarn. This is also possibly true, to a lesser extent, of the Common Blue. In the record cards Michaelis wrote: 'Tarn Fen (West) 27/7 1956, Weak colony six males seen, females not out yet? Single brooded'. Here it lives on Marsh Birds-foot Trefoil (*Lotus uliginosus*). On High Folds it uses Birds-foot Trefoil (*L. corniculatus*) and is now common, flying between the second week of June and the end of August.

RECENT COLONISERS AND VAGRANTS

There are six recent colonisers and three recent vagrant species In most cases these are species which have been spreading or increasing in abundance in wider Yorkshire (Table 1). Barnham *et al* (1993) suggest that establishment is characterised by a 'primary phase' in which individuals wander up to 20 km into unheld territory, followed by a 'phase of consolidation' when new colonies become established. This view is confirmed by recent records from Malham Tarn.

Meadow Brown (*Maniola jurtina insularis*)

The loss and absence of the Meadow Brown in the Huddersfield area is documented in detail by Fryer & Lucas (2001) and it was absent in Barnsley from 1898 until about 1940 (Rimington 1992). Over the Pennine watershed it was considered a very rare visitor in the Pendle Hill area in the 1930s (Brindle 1939). This high land is just 25 km south-west of Malham Tarn. Barnham and Foggitt (1987) noted that in the 1980s it was found in the Harrogate District only as far west as Pateley Bridge (VC64) on the Harrogate side of the high land although they reported it as present on sheltered road verges on Humberstone Bank at around 300 m. Sutton and Beaumont (1989) also noted its absence from much of the higher ground of north and west Yorkshire. Here it is still local on the intensively managed grassland and heavily grazed areas in the Craven Lowlands and the valleys of the Dales. Thomas and Lewington (1991) noted that it was seldom found at heights above 200 m in the Pennines. In the south Pennines (VC63), Whiteley (1992) shows it confined to the river valleys of the Don and Dearne below that altitude. In the Colne valley the situation was similar with the species spreading to higher ground (Fryer & Lucas 2001). Recently the species has increased its altitudinal range. It is now common on moorland edges up to 250 m to the west of Sheffield and above the Rivers Colne and Holme (Huddersfield). There are also several post-1997 records from Marsden, Meltham Moor and Holme Moss at heights of above 300 m. Since 1995 reports have been from significantly higher rough grassland sites in the north-west, including Menwith Hill. It is present in small numbers on the higher parts of the valley sides at 300 m in Swaledale, Wensleydale, Arkengarthdale and the south side of the Middle Tees (Whitaker 2000, 2001a). At Malham Tarn it was first recorded in 1999, and in 2002 small numbers were also seen at 350 m on Winskill Stones NR just 6 km to the west. In 2002 it was present on both sides of Upper Wenseleydale, at Gayle Ings SSSI (408 m), at Locker Tarn (345 m) extending up to Gooseberry Nab (400 m). Duck Street Quarry, near Greenhow (426 m), was the highest recorded colony in VC64 (Whitaker 2001a, 2002a, 2003a) The colony now established on High Folds equals this.

Comma *(Polygonia c-album)*

From its northernmost limits, Mersey to The Wash, in the seventies this species has spread north through east and central Yorkshire reaching Durham and parts of Northumberland by the mid-1980s until it almost reached the Scottish border by 2000 (Asher *et al.* 2001). This spreading appears to be associated with increased use of the Stinging Nettle (*Urtica dioica*) rather than Elm (*Ulmus* spp) or Hop (*Humulus lupulus*). It spread more slowly westwards and was rare even on the low ground of Craven until 2000. Vagrants first appeared at Malham in 1995 but it has probably been resident, feeding on nettles, since *c.*2000. It is susceptible to poor weather in early summer. At Newby Moor SSSI during the first week of June 2003, a brief spell of cold wet weather killed most colonies of small larvae in the otherwise good summer.

Small Skipper (*Thymelicus sylvestris*)

This species has undergone a massive expansion of both range and numbers from 1970 when it was largely confined to VC61 (YNU1970), and less frequent than the Large Skipper (*Ochlodes venata*) (Clough 1997, 1998). Since then it has explosively expanded its range inland as far as Middle Teesdale and through most of Durham and Northumberland to the Scottish border (Asher *et al.* 2001). A record in Harrogate in 1966 was the most westerly

record at that date. It then colonised all suitable sites in the Harrogate district by 1984 (Barnham *et al.* 1987) and was established on the southern edges of the Yorkshire Dales to the south and west of Malham around Hellifield and Long Preston, having spread up the Ribble Valley and into Gisburn Forest by 1995. Its spread up the Ribble Valley and over into the head of tributaries of the Lune continued rapidly as follows: Giggleswick Scar (1997), Lawkland Moss SSSI and Austwick Moss SSSI (1998), Cold Cotes Waste (1999) Langcliffe (2001), Swarth Moor SSSI, Wharfe Wood SSSI, Newby Moor SSSI and Brae Pasture NR, Selside (2003). Colonisers establish rapidly and large populations build up within two years. On Swarth Moor SSSI only two were seen in 2002 but by the next year they outnumbered the Large Skipper on the transect, 3:1. The first Small Skipper was seen at Malham Tarn in 2000, two on High Folds in 2002 and nine at various locations during 2003.

Large Skipper (*Ochlodes venata*)
There are some indications that the Large Skipper may now be more widely distributed than earlier in the last century. It had spread widely into Durham by 1985 and Northumberland by 2002) (Dunn & Parrack 1986, Hunter 2003). It may be present at higher altitudes but there is no firm evidence for Yorkshire. It was first recorded at Malham Tarn in 1996 (Clough 1997). Shaw (2001) noted a significant decline of the Large Skipper on a number of Cheshire sites which the Small Skipper had colonised and wondered if the cause could be competition. However there is no competition for foodplants. The Small Skipper uses Yorkshire Fog (*Holcus lanatus*) and most colonies of the Large Skipper use Cocksfoot (*Dactylis glomerata*) but occasionally use Purple Moorgrass (*Molinia caerulea*) on a few sites the where the Small Skipper is rarely found. Adult males of both species are aggressively territorial but the Large Skipper is generally more robust. They possibly compete for the same nectar sources but the earlier emergence of the Large Skipper should give it an advantage. It will be interesting to observe what happens at the many Yorkshire Dales sites where the Small Skipper has recently appeared.

Small Copper (*Lycaena phlaeas*)
It is uncertain when the Small Copper was first became resident at Malham. Small colonies are widespread wherever species of Sorrel (*Rumex*) occur in warm spots. Its abundance is highly weather dependent and numbers in Yorkshire as a whole were low in the mid-1980s. On higher ground it is often associated with heather moorland where rotational burning produces warm bare earth, an abundance of Sheep's Sorrel (*Rumex acetosella*) and heather provides plenty of nectar. It could have been present pre-1950, when Tarn Moss was managed for grouse shooting.

Orange Tip (*Anthocharis cardamines*)
Although often locally abundant on low ground the Orange Tip is rare above 250 m. Sutton & Beaumont (1979) recorded a considerable expansion of range in Yorkshire and Durham since 1972, part of the northward range expansion reported since the mid-1940s. Since 1990 it has gradually spread up the valleys of the Pennines and the Yorkshire Dales but its establishment at Malham Tarn around 1996 represents colonisation at an unusually high altitude.

Ringlet (*Aphantopus hyperantus*)
Since 1972 the Ringlet has been filling in the gaps of its nationally discontinuous distribution. Its spread from the east to the west in Yorkshire has progressed steadily since 1980 when it was present east of a line roughly following the A1 trunk road and the lower Ure Valley (Barnham & Foggitt 1987). In 1992 it was present at Masham (Lower Wenseleydale) and moved into the Dales (Barnham *et al* 1993) where it became established in middle Swaledale Upper Wensleydale and Middle Wharfedale in the mid-1990s. By 1999 it was established in Upper Wharfedale and Nidderdale but apart from a few vagrants was not known west of there until 2003 when it established on Studfold Moss (Swarth

Moor SSSI) and a large colony was discovered at Otterburn Moor Forest 1 km north-west of Otterburn which may have been there for several years. It is uncertain as to whether the Ringlet is now established at Malham or whether the two individuals seen were part of the continued scatter of vagrants reported from the southern Dales. Like the Meadow Brown this species has been found on much higher sites than ever before, Duck Street Quarry (385 m) near Greenhow being one of the highest locations in 2001 (Whitaker 2001b, 2002).

Vagrants

Recently the Gate Keeper (*Pyronia tithonus*) and the Brimstone (*Gonepteryx rhamni*) have been observed as vagrants at Malham Tarn. The former is another spreading species which has given rise to a scattering of vagrants in the Dales in the last few years but it is spreading at a very much slower pace than its close relative the Ringlet. Its nearest established colonies, in Airedale near Shipley and on Sun Lane NR (Burley-in-Wharfedale) in the middle Wharfe Valley, are not all that close (Whitaker 2003b, 2004b in press). The Brimstone appears stable at the limits of its range imposed by the distribution of its food plants Alder Buckthorn (*Frangulus alnus*) and Purging Buckthorn (*Rhamnus catharticus*), which are at their northern limits in the northern English counties and are rare in the Yorkshire Dales.

Reasons for new colonisers

The ranges of most butterflies are restricted by temperature and at the extremes of their ranges they occupy only the warmest habitats. A combination of habitat availability within a reasonable distance from established colonies, and climate change, mainly regional warming, appears to explain the pattern of spread of many of many of the species involved here (Hill *et al.* 1999, 2002).

Climate

The weather of the Malham Tarn area (380-425 m) is typical of the Craven Highlands although it may be less cloudy than areas further north and west. It was summarised by Sinker (1960) (from Manley 1957) as 'windy, humid, and cloudy, with rainfall well distributed over the year and a fairly long snowfall period'. There is ample evidence that the UK climate is changing. Central England Temperatures (CET) in the period 1980-2002 have risen by about 0.8°C in comparison to the mean of the period 1961-90 (Parker *et al.* 1992), mostly in the last ten years. This is even more obvious graphically when one considers the mean minimum CET, where relative temperatures have increased by 0.7°C since 1990 (Figure 3). At Malham the temperature trend is similar, as indicated by the data from the Meteorological Office recording station in Tarn Close (Table 2). Precipitation patterns have also changed. Summers are now not only warmer but drier in summer (Figure 4), a marked amelioration if this holds good for the Central Pennines which is one of the cloudiest areas of England. At Malham the hours of sunshine appear slightly down and the occurrence of increased summer sun needs closer examination. An increase of 0.75°C compensates for

TABLE 2
Meteorological data for two periods (Malham Tarn, 381 m AMSL)

	Maximum Temp [deg C]	Minimum Temp [deg C]	Days of Air Frost [days]	Sunshine [hours]	Rainfall [mm]
Met Office averages 1961-1990	9.8	3.8	84.2	1166.4	1491.5
Met Office averages 1971-2000	10.1	4.0	79.1	1148.8	1518.4
Difference	**+ 0.3**	**+ 0.2**	**–5.1**	**– 17.6**	**+ 26.9**

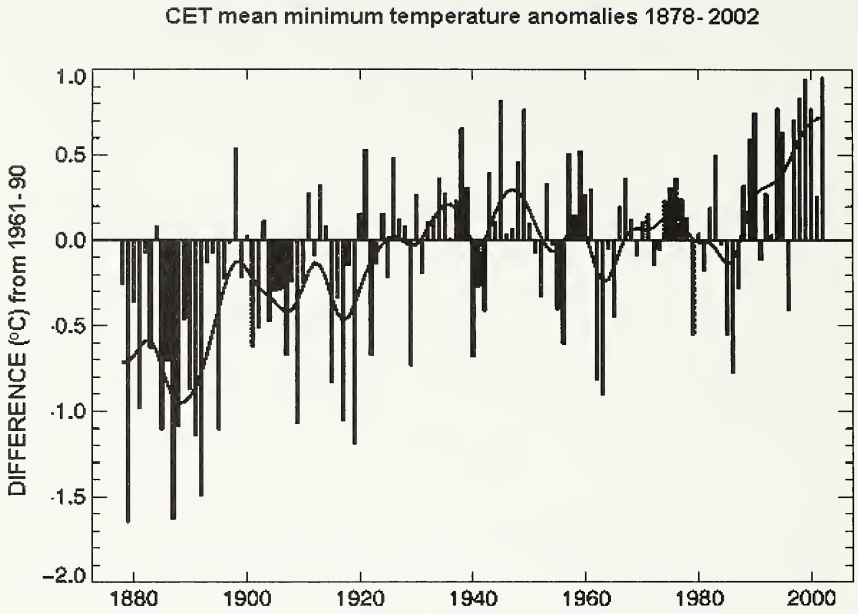

FIGURE 3
Seasonal England and Wales precipitation (High Summer & Winter, 1873-2003) after Met. Office Hadley Centre for Climate Prediction and Research.

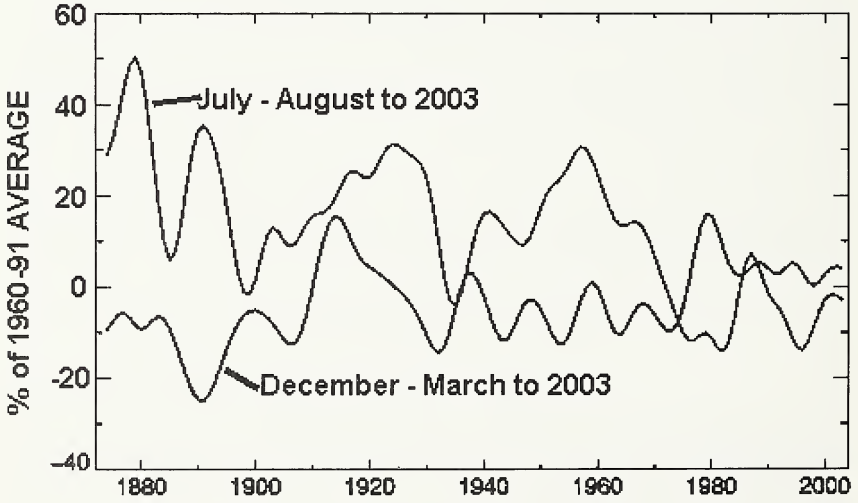

FIGURE 4
Central England temperature (annual anomalies, 1772-2002). after Met. Office Hadley Centre for Climate Prediction and Research (Parker *et al.* 1992).

*c.*100 m increase of altitude, given normal thermal lapse rates with altitude. Such a change could easily explain the observed spread of some species to higher sites.

Habitats

Sinker (1960) described in detail the vegetation around Malham Tarn. Because the Malham Estate has been managed by the National Trust as one unit since 1948, the habitats close to the Tarn remain relatively unchanged, in contrast to the wider Dales area The grassland especially is better managed. However, part of High Folds is currently threatened by recent tree planting and shading by self-sown ash and the increased height of trees at the edge of Tarn House Plantation. Woodland has generally been badly managed with inappropriate planting at Ha Mire Plantation and neglect has promoted a dense canopy in Tarn House Plantation. Fortunately neglect has also resulted in tree death, mainly caused by ring barking by sheep. The northern side of Ha Mire Plantation has thinned markedly to give a more open woodland with a ground flora which includes *Viola riviniana* and other forbs, which paradoxically is much more suitable for butterflies, including the Dark Green Fritillary. The difference is obvious if one studies a photograph (Plate 1 in Sinker 1963) which shows a dense canopy on all of Ha Mire Plantation. Tarn Moss and Tarn Fen have remained unmanaged from 1948 until recently and scrub Birch was spreading into the less acid parts. This problem is now being addressed.

Key butterfly habitats

The key conservation habitat for the Northern Brown Argus and Dark Green Fritillary is considered to be the warm, stony, calcareous grassland of High Folds. In addition to this habitat, Tarn Close and Ha Mire Plantation and the adjacent fen meadow by the south-east shore support violets and nectar plants vital for the Dark Green Fritillary. Tarn Moss supports the foodplant and Tarn Fen provides territory markers and nectar plants for the Green Hairstreak. It is important to retain an open vegetation structure and a sunny aspect on all of these areas.

Conservation measures for the habitat specialist butterflies

It is recommended that especially tall trees shading the talus slopes and calcareous grassland, are removed from the area adjacent to High Folds Scar, especially the recently planted trees in the south-east corner and all self-seeded ash saplings. Deliberate grazing should not be permitted in this area, although it will be impossible to restrict Roe Deer. In the south-eastern part of Ha Mire Plantation, old dense canopied larch has been felled and there is the opportunity for replacement trees, such as oak, ash, holly, hawthorn and rowan, to be planted sparsely as part of a very open new planting scheme incorporating clearings. If the sward of the open parts of the wood could be grazed periodically (without damaging any trees) this would reduce the rankness of the ground cover and benefit biodiversity. Although Sinker (1960) referred to Tarn Close as old 'Improved' grassland, this is now florally rich and is being grazed by traditional breeds of cattle which will conserve a major area of nectar flowers for butterflies. The open nature of most of Tarn Fen is also important to many butterfly species including the Green Hairstreak and it is vital that birch and sallow does not spread. Grazing with cattle could be an ideal management tool.

What of the future?

The Holly Blue (*Celastrina argiolus*) shows large cyclic fluctuations in abundance and currently appears to be spreading in Yorkshire and increasing in abundance once more (Asher *et al.* 2001). It was known at Malham Tarn from only two records (Tarn House Plantation 26/4/1948 and School House, Water Houses, Malham Tarn, 6/8/1950) when it was at a previous extreme of its range at a peak of its abundance. It then disappeared (Michaelis 1963). However the species is now established in the Settle area and as there will probably be a new population peak in the next few years it could once again appear at Malham Tarn. It is suggested that Malham will eventually see the Ringlet as a resident

species and that the populations of Small Skipper and Orange Tip will increase. The Gatekeeper will possibly become a common vagrant and another spreading species, the Speckled Wood (*Pararge aegeria*), may be recorded for the first time.

Acknowledgements

I would like to thank Butterfly Conservation (Yorkshire Branch) for permission to use data from the county database and Richard Fox of Butterfly Conservation for additional information from the Biological Records Centre (1967-82) dataset. I also acknowledge the large contribution to the knowledge of Malham butterflies made by individual recorders, especially Brian and Elizabeth Shorrock. Finally I would like to thank Geoffrey Fryer for his careful scrutiny of the draft manuscript and his helpful suggestions which greatly improved the final publication.

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BOOK REVIEWS

British and Irish Pug Moths: a guide to their identification and biology by **Adrian M. Riley** and **Gaston Prior.** Pp. 264, incl. 12 colour plates & numerous text figures. 2003. Harley Books. £29.50 hardback.

This long awaited book makes identification of a difficult group of moths considerably easier. Adults are illustrated firstly in taxonomic order, then with similar species grouped together and finally in a series of colour photographs showing the moths in their resting postures. Detailed line drawings illustrate genitalia and larvae. Interspersed in the text are more sketches showing wing shape and diagnostic features of similar species. Distribution maps on a vice-county basis are provided for each species. Introductory chapters deal with how to use the book, a historical review, and breeding and rearing pugs. Also provided are a glossary, table of phenology, index of foodplants, an extensive bibliography and a synonymic index.

The novel approach to identification coupled with the quality of the plates and illustrations make this an essential tool for the identifier of pugs. It will inevitably be compared with Vol. 4 of *The Geometrid Moths of Europe* also published in 2003, which has larger illustrations of adults and genitalia diagrams emphasising some different features. The true pug enthusiast will need both in his library. CHF

Sex Wars, Genes, Bacteria and Biased Sex Ratios by **Michael E. N. Majerus.** Pp. xix + 250, with 8 colour plates & b/w illustrations. 2003. Princeton University Press. US $45.00 hardback.

Half of this book is basically a textbook on reproduction, sexual and parthenogenetic, that deals with sex ratios, how sex is determined, and the various ways in which Mendel's laws of genetics can be broken and the consequences of so doing. While some topics seem remote from the pursuits of naturalists, a remarkable array of reproductive habits provide points of contact. Observation is vital to answer such questions as why in some cases females of many animals display bright colour or elaborate adornments.

The standard argument is advanced that, because sexual reproduction more rapidly generates a diversity of variants than does parthenogenesis, it is self-evident that this will enable its practitioners to adapt more easily to changing conditions and thereby survive them better. However, although highly improbable in theory, the ostracod *Darwinula stevensoni*, which reproduces entirely by parthenogenesis and has a rich, all-female, fossil record, has persisted for at least 20 million years, and darwinuloids as a group may have been parthenogenetic for more than 100 million years. Such cases, not mentioned by the author, suggest that nature may solve problems in more ways than one.

The sex of organisms can be tampered with in various ways. Some micro-organisms that live as symbionts or parasites of invertebrates can manipulate the sex or sex ratio of their host. In the woodlouse *Armadillidium vulgare* the female is the heterogametic sex (WZ), the male hormogametic (ZZ). A species of *Wolbachia*, a symboitic bacterium, feminizes males. Chromosomally these remain males but sex is no longer determined by the chromosomes, but by the *Wolbachia*. Infected ZZ 'males' behave as females: uninfected ZZ males remain such. Feminization of the host is advantageous to the bacterium, which is maternally inherited. In some invertebrates, including the African butterfly *Acraea eponina*, feminized males treated with antibiotics have their masculinity restored! Microsporidians of the genera *Nosema* and *Octosporia* feminize the amphipod *Gammarus duebeni*, misleadingly called the 'brine shrimp', a name applied by universal consent to the anostracan *Artemia*.

Other parasitic micro-organisms kill males of their host. Some do so late in their development, others early. Several mosquitoes host late male-killing microsporidians: early male-killers (several bacteria, including *Wolbachia*) frequent insects of several orders. Various bacteria – *Rickettsia,* a *Spiroplasma*-like form and two strains of *Wolbachia* – are male-killers of the Two-spot ladybird beetle, *Adalia bipunctata*. Other ladybirds host yet other male-killing bacteria. Killers operate at the egg stage of the host, killing very early in the development, so females hatching from a clutch of eggs are provided with an initial nutritious meal of dead eggs. As the benefitting bacteria are from the same clone as those that perish with the male victims, and genetically identical to them, this appears to be an example of kin selection. In one locality four different male killers have been found in *A. bipunctata*, which in theory is supposedly impossible! Contemporary faith in models is reflected in the remarkable statement that better models "might permit co-existence"! It is not yet known how killers recognise the sex of their host, nor how they kill males.

Wolbachia, and so far no other micro-organism, is known to induce parthenogensis in more than 30 parasitoid wasp and a few other arthropods. The consequences, evolutionary and otherwise, of these remarkable phenomena are explored.

Dealing as it does with a relatively new field, likely to be unfamiliar to naturalists, this is a vista-widening book. Naturalists can learn from it but should not be overawed. They probably know things that the author does not: for example that there is no fungus of the genus *Laboulbeniales*. This is the Ordinal name of a large group of fungi that are ectoparasites on insects.

GF

YORKSHIRE NATURALISTS' UNION EXCURSIONS IN 2001

COMPILED BY
A. HENDERSON AND JANETTA LAMBERT

NOTE: Some changes of date and venue were inevitable in 2001 due to the major outbreak of foot-and-mouth disease which closed much of the countryside to public access. Richmond and Foxglove Covert, Wykeham Lakes and the Meanwood Valley area were speedily arranged substitutes which, in the event, proved to be surprisingly rewarding sites. Fortunately, at Manor Farm and Cannon Hall no rearrangement was necessary.

RICHMOND AND FOXGLOVE COVERT (VC65) 19 May 2001

RICHMOND

INTRODUCTION (**A. Henderson**)
Eleven members and a guest attended the Richmond/Foxglove Covert venue, a rather hasty rearrangement of meeting place as a result of the severe foot-and-mouth outbreak. The morning was spent within Richmond north of the river; the mediaeval Castle, the sloping woodland overlooking the Swale, and the riverbank attracting most attention.

MOLLUSCA (A. Norris)
The morning was spent on the north bank of the river Swale, the south facing castle walls and woodland leading down to the river, all within NZ(54)/1700. In all, 26 species were recorded. David Lindley made one of the most interesting finds, a specimen of the slug *Boettgerilla pallens*; this is only the second record for VC65. A single specimen of *Monacha cantiana* was also found; this species being at the extreme edge of its distribution within the county at this locality probably accounts for only one example of this common snail being found.

COLEOPTERA (W. R. Dolling and F. E. Kenington)
The weevils, *Ceutorhynchus pallidactylis* on Wallflower and *Aseidapion radiolus* on Mallow at the castle base, were found along the Castle Walk. By the bridge over the Wharfe, the footpath into the wood was found to be closed, so attention was directed to the riverbed and bank. Here, *Bembidion tibiale*, a typical small carabid of stony river edges, was found. A specimen of *Calvia quatuordecimguttata*, the 14-Spot Ladybird, was found dead in river drift, and another carabid *Agonum albipes* under a stone on the bank. Sweeping the riverside vegetation produced *Phyllobius pomaceus,* a fairly large green weevil usually associated with nettles.

ENTOMOLOGY (W. R. Dolling)
In the morning, near the castle in Richmond *Nabis rugosus* (Hemiptera) was seen. This is a common insect, known from 41 Yorkshire records (as at October 1996, according to the Recorder, Stuart Foster). Merely 3 records from VC65 show how poorly worked it is for this group of insects. A pondskater on the river Swale was probably the common *Gerris lacustris* but no specimen was taken to confirm the record; on the Recorder's database, however, it is represented by 57 records, none of which is from VC65. In the same place, another Hemiptera receiving careful examination was *Velia caprai*, found on a pond; there are 62 Yorkshire records for this species and 5 records from VC65.

FLOWERING PLANTS (I. C. Lawrence)
The morning was spent in Richmond itself, starting at the castle where *Erysimum cheiri* and *Parietaria judaica* were prominent on the walls. The woods and riverside gave us

Stellaria nemorum, Ribes alpinum, Hesperis matronalis and on some bare ground a Willowherb, later determined as *Epilobium lanceolatum*!

Bryophytes (J. M. Blackburn)
The morning started with an inspection of the castle walls. Little of interest was found except for a healthy colony of *Eucladium verticillatum* in a damp spot on the south-facing wall. The riverbank upstream of the bridge on the south side of the River Swale was much more interesting. The riverside rocks had *Cinclidotus fontinaloides, Dichodontium pellucidum, Fontinalis antipyretica, Homalia trichomanoides, Rhizomnium punctatum, Chiloscyphus polyanthos, Conocephalum conicum, Lunularia cruciata* and *Marchantia polymorpha* ssp. *ruderalis*. Common woodland species, such as *Mnium hornum, Eurhynchium striatum, Rhynchostegium confertum* and *Thamnobryum alopecurum*, were present, and the limestone rocks had a fine collection of calcicoles, with *Encalypta streptocarpa, Homalothecium sericeum, Neckera complanata, Syntrichia intermedia, Jungermannia atrovirens* and the beautiful thalloid liverwort *Apometzgeria pubescens*.

Lichenology (A. Henderson)
Study was concentrated on the inner castle walls and grounds, where the lichen flora showed a pronounced calcareous influence with *Aspicilia calcarea, A. contorta, Caloplaca flavescens, Lecanora campestris* and *Protoblastenia rupestris* the commonest and most striking elements, and with *Belonia nidarosiensis* lending a pinkish hue to some of the shadier, damper stretches of wall. Massed tiny folioles of *Agonimia tristicula* were frequent on mossy patches and occasionally overgrowing *Collema fuscovirens*, which formed a minimal gelatinous community with *C. auriforme*, *C. crispum, Leptogium gelatinosum* and *L. turgidum,* and *Opegrapha saxatilis* agg. occurred infrequently on wall ruin. The two hours available were far from sufficient for an examination of this old castle flora.

FOXGLOVE COVERT

Introduction (**J. G. Lambert**)
In the afternoon we gathered at the entrance to Cambrai Barracks at Catterick Garrison where we were met by Major Tony Crease who escorted us across the camp and onto the nature reserve. At the well-appointed cabin used by the regular group of bird-ringers, Major Crease described the layout of the reserve and we were provided with excellent maps of the area.

During the day the weather was mild, and in some places there was a fine show of spring flowers. Signs or sightings of Short-tailed Field Vole, Mole, Rabbit and Roe Deer were reported. Common Frog, Common Toad, Great-crested Newt and Bullhead were also seen, the last species being reported on the Union's previous visit. Only a few, mainly woodland birds were noticed, including Chiffchaff and Willow Warbler. A Tree-creeper's nest was observed; Moorhens were nesting and a Cuckoo was heard. Later, Major Crease joined members for a very pleasant tea and report meeting, where the day's finds were discussed. We thanked him for giving his time to show us this interesting reserve which was last visited by the Union in 1995.

Mollusca (A. Norris)
The afternoon was spent recording within the Foxglove Covert Nature Reserve, which is located within the Catterick Garrison military enclave. The reserve is contained within four 1 km squares; only one of these squares could be surveyed (SE 44/1696), and there was time for only a casual look at one or two specific sites in other areas of the reserve. The total list of land and freshwater molluscs for this reserve will certainly be expanded in the future, possibly to 50 species or more; 42 were recorded on the day of the YNU visit. Several species recorded are worthy of note, including *Columella edentula*, which proved

to be abundant in some areas, *Punctum pygmaeum*, a very small species rarely recorded in the field, *Monacha granulata* a snail of rich, marshy habitats, and *Perforatella subrufescens*, a species associated with wet ancient woodland.

COLEOPTERA (W. R. Dolling and F. E. Kenington)

Netting in a small stagnant pool near the cabin produced *Helephorus grandis*, one of the crawling water beetles. Moving on past the Heligoland bird trap to a pool in the valley by Risedale Beck yielded *Hydrobius fuscipes, Laccobius bipunctatus, Limnebius truncatellus, Anacaena globulus and A. lutescens.* Returning to the cabin area a 'rove beetle' *Lesteva longelytra*, which, as its name implies, has very long wing cases for a member of the family Staphylinidae, was sieved from the debris under a gorse bush. Waste food dropped below a bird feeder contained the ground beetles *Bembidion harpaloides, B. aeneum* and *Pterostichus strenuus* with the Staphylinidae, *Othius punctulatus, Tachinus signatus, T. marginellus, Anotylus rugosus, A. tetracarinatus, Quedius scintillans, Omalium rivulare, Lathrobium multipunctatum* and another Hydrophilid, *Cercyon melanocephalus.*

To the north along the excellent metalled paths a couple of small linked ponds were located but no water beetles were found, only a leaf beetle *Phaedon cochleariae* on pondside plants. Shaken Blackthorn blossom nearby yielded a weevil *Polydrusus pilosus* and an orange-brown species of the Nitidulidae, *Epurea aestiva.*

The pear-shaped weevil *Protopirapion atratulum* was shaken from a gorse bush and general sweeping turned up further weevils *Sitona striatellus* and *Ceutorhynchus assimilis*. Working more to the northwest *Ceratapion gibberostre* was shaken from birch and *Exapion ulicis, Micrambe vini, Philorinum sordidum* and a female *Scymnus suturalis*, a species of Coccinellidae (Ladybirds). By general sweeping, the Chrysomelidae *Lochmaea caprea*, *Galerucella lineola* and *G. tenella* were found.

By banging together fungoid sticks *Bolitochara oblique* and *Micropeplus tessarula*, a small (1.5 mm) and very broad Staphylinid with strong ridges on the pronotum, elytra and abdomen, were obtained. Of the four British species of this genus, *M. tessarula* is probably the least common with few Yorkshire records. The ground beetle *Calathus micropterus* was obtained by 'grubbing'.

A couple of water beetles found in larger ponds to the north by David Lindley were a further example of *Hydrobius fuscipes* and a larger water beetle *Agabus chalconatus*. A *Carabus* found amongst moss was most probably *C. violaceus*.

A total of fifty-six species were found on the day.

ENTOMOLOGY (W. R. Dolling)

The following species of Hemiptera were seen (the current numbers of Yorkshire records and VC65 records respectively being indicated in brackets after each species name): *Psylla melanoneura* (28, 2) on Hawthorn; *Ulopa reticulata* (37, 2) under Heather; *Macustus grisescens* (63, 0) and *Javesella discolor* (66, 1) on grasses; *Cymus glandicolor* (25, 0) on sedges and rushes; and *Anthocoris nemoralis* (105, 5) and *A. nemorum* (142, 6) on trees, shrubs and herbs; *Xylocoris cursitans* (13, 1) in a log pile; *Stenodema holsatum* (104, 7) on grasses; and *Microvelia reticulata* (14, 0) on a pond. Other insects were one butterfly *Pieris napi* resting on *Cardamine pratensis* and the lacewing *Hemerobius nitidulus*, one female, on Scots Pine.

BOTANY (I. C. Lawrence)

Foxglove Covert is an old Willow Carr consisting mainly of *Salix cinerea* ssp. *oleifolia*. In the drier areas *Betula pendula* and *B. pubescens* were prevalent with coppiced *Corylus avellana*. *Salix aurita* was noticed, as was *Prunus domestica* ssp. *institia*. The ground flora consisted of *Carex viridula* ssp. *oedocarpa, Stellaria uliginosa, Geum rivale* and *Dryopteris carthusiana* in the wet area. By the stream and around the various ponds were *Alisma plantago-aquatica, Apium nodiflorum, Galium palustre, Hippuris vulgaris, Menyanthes trifoliata, Ranunculus lingua, R. flammula, Scrophularia auriculata, Mentha*

aquatica and *Equisetum fluviatile*. On the drier heathland *Viola canina* was growing with *Galium saxatile* and *Lathyrus linifolius*. At least 120 species were recorded for the area.

BRYOPHYTES (J. M. Blackburn)
The afternoon in Foxglove Covert was eagerly anticipated as no bryophyte recording had been done on the reserve. The area is primarily acidic with just one base-rich flush near Risedale Beck which had a large patch of *Palustriella commutata* var. *commutata* and *Ctenidium molluscum*. The first interesting find was a fine patch of *Calliergon cordifolium* in marshy ground near the field centre. Other wet areas had *Brachythecium plumosum, B. rivulare, Bryum pseudotriquetrum, Hygrohypnum luridum* and *Sphagnum squarrosum* , the latter being the only member of the genus present on the reserve. The drier heathy and grassy areas contained *Brachythecium rutabulum, Cirriphyllum piliferum, Dicranella heteromalla, Dicranum scoparium, Eurhynchium praelongum, E. striatum, Mnium hornum, Pleurozium schreberi, Scleropodium purum* and *Rhytidiadelphus squarrosus*. Epiphytes seen included *Dicranoweisia cirrata, Orthodontium lineare, Orthotrichum affine, Ulota bruchii* and some large patches of *U. phyllantha* with prominent clusters of brown gemmae on the leaf tips. A total of 53 species of bryophytes was recorded and the reserve would repay a more extensive examination.

LICHENOLOGY (A. Henderson)
While our transport was lined up for entry into Cambrai Barracks, some interest was excited by the occurrence of folioles of *Xanthoria parietina* and initial thalli of *Lecania erysibe, Lecanora dispersa* and *Rinodina gennarii* on the side-window sealing of a member's Cherokee Jeep. Such opportunistic colonisation of man-made rubber substrata is not unusual.

The lichen flora of the Covert areas examined is not prolific, but yielded 29 species, mainly corticolous or lignicolous, many of them recently invasive and so promising a degree of future lichen enrichment. Most interesting, perhaps, was *Candelariella reflexa,* with *Lecania cyrtella*, sprinklings of young *Lecanora chlarotera* on smooth bark, the occasional patch of *Buellia griseovirens,* and silvery crusts of *Phlyctis argena* and *Ochrolechia turneri*: also the crowded fruits of *Lecanora saligna* and a golden fuzz of *Xanthoria candelaria* dominating an old wooden post.

MANOR FARM, EDDLETHORPE (VC61) 9 June 2001

INTRODUCTION **(Bill Meek)**
Manor Farm, a 165-hectare all-arable enterprise near Malton, is now owned and managed by the Farmed Environment Company, which has its roots in agri-business, but also has fifteen years' experience of habitat creation on arable land. Manor Farm is used as a whole-farm demonstration to show how increased biodiversity can be achieved without damaging farm profits and was the subject of an item on BBC TV's Countryfile featuring David Bellamy in summer 2000.

The lowest-yielding 5% of land has been removed from production and given over to the creation of new wildlife habitat, which has in part attracted grant aid. The Farm hosts a number of replicated trials into the effects of different margin types and configurations, as well as other habitat creation schemes. Manor Farm also contains fragments of ancient woodland, including a lengthy piece in the valley of Howl Beck. Across the Beck on the facing slope is an area of extremely species-rich old MG5c grassland with important wet areas towards its base.

The tea and reports meeting was held in the Farm Visitors' Centre where members relaxed, enjoying the generous hospitality, much appreciated after a busy day in the field.

MAMMALS (A. Norris)
The regime of Manor Farm Estate is such that care is taken not to disturb wild mammals or discourage their establishment. Nowadays Water Vole, Fox and Brown Hare are rare sightings. The estate boasts a number of active Badger setts, as well as large Mole and Rabbit populations. One member reported seeing deer; Bill Meek, our host for the day stated that this would have been a Roe Deer, one of a number established in the area. There was evidence in many parts of the estate woodland of thriving small mammal populations; a systematic study of the area, using Longworth traps and bat detectors, could well produce a number of surprising mammal records.

ORNITHOLOGY (B. Cockerill and J. Lambert)
Overcast weather and cool conditions kept everything quiet, hence the somewhat disappointing list of only 24 species. Hirundines were well represented, with Sand Martin, House Martin and Swallows, as were Warblers with Willow Warbler, Chiff-chaff, Whitethroat, Garden Warbler and Blackcap. The seed-eating species, Greenfinch, Chaffinch, Goldfinch and Yellowhammer, may have benefited from the variety of wild plants which flourish on the farm. Tree Sparrows were seen and breed on the site. House Sparrows were not recorded.

MOLLUSCA (A. Norris)
The molluscan population far exceeded our expectations with a number of important records. David Lindley recorded a specimen of the slug *Boettgerilla pallens*, the first record for VC61. Four species belonging to the Vertiginidae were also found, any one of which would have made the journey worthwhile.

31 species of mollusc were recorded from the meadow, including *Columella edulenta, Vertigo antivertigo* and *V. substriata*. On the wooded bracken-covered slopes opposite we recorded the fourth Vertiginid species *Columella aspersa*; this is also the first record for VC61. The light warm showers may not have encouraged the entomologists, but the weather did encourage the slug populations, with finds of 14 species including *Limax maximus*, *L. cinereoniger, L. flavus* and large numbers of the tree slug *Lehmannia marginata*.

LEPIDOPTERA (J. Payne)
Most of the time was spent on the walk to Howl Beck. The valley side had good stands of Crosswort, Pignut and Bitter Vetch in flower.

The *Galium* feeders, Common Carpet *Epirrhoe alternata* and Silver-ground Carpet *Xanthorhoe montana*, were seen and numerous Chimney Sweepers *Odezia atrata* flew in the brief sunny period. A Cinnabar *Tyria jacobaeae* was reported. The only butterfly reported here was a single Small Copper *Lycaena phlaeas*.

A couple of web-dwelling larvae collected on Meadowsweet and bred out later were *Aphelia paleana*, a member of the Tortricidae with plain cream forewings and grey hindwings. A perfect insect emerged from one pupa, the other had been 'stung' and an ichneumon fly emerged. Ova of Orange-tip *Anthocharis cardamines* were seen on Garlic Mustard by the lane and a few larvae were taken from a beating tray there. Two of these were Common Quaker *Orthosia cerasi*, a member of the Noctuidae. Others were members of the Geometridae, commonly known as 'loopers'.

Several larvae of the strikingly coloured Yellow-tail *Euproctis similis* were brought in off hedges and with a full grown Drinker larva *Philudoria potatoria* were exhibited at the meeting.

Round the pond Silver-ground and Common Carpet were seen again and a Common White Wave *Cabera pusaria* was flushed from alder. Several newly emerged Green-veined Whites *Pieris napi* were in the long damp vegetation and a single Small White *P. rapae* was reported.

COLEOPTERA (F. E. Kenington)

After the briefing at the field centre most of the party set off westwards along the field headland towards Beck Dale. Sweeping the vegetation along the track where it dips at the pond end revealed two Soldier beetles, *Cantharis cryptica* and *Rhagonycha lignosa*, a click beetle *Agriotes pallidulus* and two weevils, *Tropiphorus terricola* and *Ceutorhynchus asperifolium*. Work with a water net produced only one water beetle which was in the upper lake near the outlet staging; this was *Ilybius fuliginosus*, *c.*10 mm long with a yellow band along each side.

Moving along the field margin towards Beck Dale some old damp straw produced the Rove beetles, *Sepedophilus marshami, S. nigripennis, Tachinus rufipes, Stenus similis* and *S. bimaculatus*, the last species being one of the few in the genus with orange spots on the elytra. The rest of this large genus are black but in some species the legs or antennae may be wholly or partly coloured. The field margin clods also produced the Carabids *Pterostichus strenuus* and *P. madidus*.

In the meadow at the north end of Beck Dale Wood the bright blue Flea beetle *Altica lythri* was found on Willowherb, and Alder in the wood edge produced a large weevil *Liophloeus tessulatus*. Turning over logs by the entrance to the wood yielded more ground beetles from the leaf litter: *Leistus rufescens, Bembidion tetracolum, Pterostichus strenuus,* and *Amara plebeja*. A new species for the recorder, present in good numbers, was *Leistus spinibarbis*, a strikingly iridescent blue insect, restricted to damp woodlands; also present was the small longhorn *Grammoptera ruficornis* which is not restricted to woodland but is widespread, occurring in the recorder's garden in Holderness, often on Hawthorn blossom.

A young coleopterist, Sophie Lindley, found some of the most interesting beetles of the day: the Cardinal beetle *Pyrochroa serraticornis* and the Rhinoceros beetle *Sinodendron cylindricum*. Later, eight samples of the latter species were visible in a log, with probably many more present in the soft rotten wood. F.E.K. and L.A. searched alder for the bright green Leaf beetle *Chrysomela aenea* in vain, but one specimen was produced by Sophie at the afternoon meeting.

Shaking a Larch at the wood edge produced another large brown weevil *Otiorhynchus singularis* as well as *Brachypterus glaber, Cyphon coarcticus* and another click beetle *Dalopius marginatus*. Rain prevented the recorder from reaching the far side of Beck Dale but bushes and other vegetation were explored nearer the farm. The additional beetles *Cantharis nigricans, C. pellucida* and *Rhagonycha limbata*; the click beetles *Athous haemorhoidalis* and *Denticollis linearis*; the weevils *Phyllobius argentatus, P. pyri, P. pomaceus* along with the pear-shaped weevils *Apion dichroum* and *A. violaceum*, the Celery beetle *Phaedon tumidulus, Adalia decempunctata* and *Elodes minuta* brought the day's total to 42 species.

PLANT GALLS (J. Payne & K. G. Payne)

Galls caused by a total of 12 species were collected by J.P. Oak yielded only those of *Biorhiza pallida* (oak apples) and of *Andricus curvator*, the cause of severe distortions in twigs and leaves. Eight galls, all common, were the work of Eriophyid mites. These included erinea (areas thick with modified hairs) below sycamore leaves, swollen leaf edges on blackthorn and, unusually plentiful, swollen leaf buds of hazel. The last are very similar to those of Black Currants affected by 'big bud'. Fungus galls were represented by swollen and distorted sloes caused by *Taphrina pruni*. There were very few affected fruit and the blackthorn bore mainly healthy fruits. The rust fungus *Puccinia tumida* had caused galls on the pignut *Conopodium majus*.

FLOWERING PLANTS (D. R. Grant)

The area visited is situated on the Jurassic series of rocks, represented by the Estuarine series and Lias clay, which give rise to mildly acidic soils, but there are small isolated calcareous patches. On the very eastern boundary of the farm there is a pocket of pure sand. The Howl Beck forms a shallow valley flowing north into the river Derwent.

The hillside meadow was full of *Conopodium majus* in full flower. The drier parts of the meadow had *Stachys officinalis* and *Stellaria graminea,* while slightly damper parts had *Carex flacca, C. panicea* and *C. hirta,* growing with *Succisa pratensis, Ajuga reptans, Festuca arundinacea* and *Juncus acutiflorus.* The marsh at the southern end had *Caltha palustris, Equisetum palustris* and *Dactylorhiza fuchsii.* The marsh at the northern end had a large bed of *Carex acutiformis.*

On the higher ground by the boundary hedge the brambles *Rubus nemoralis, R. dasyphyllus* and *R. warrenii* were growing in large colonies. The edge of the woodland had some healthy young trees of *Ulmus glabra.* On the eastern side of the farm, drainage ditches had *Sparganium erectum* and *Scrophularia auriculata.* Examination of the sandy area yielded much *Viola arvensis* and *Aira praecox,* which were growing with *Aphanes arvensis* and *Scleranthus annuus.*

Bill Meek took a party of botanists to see a population of the unusual species of Wintercress *Barbarea intermedia* by the hedge just inside a farm gate.

Mycology (G. Brand)

As is usual in June, few fruit bodies of larger fungi were seen, but Janetta Lambert found fresh specimens of *Agrocybe praecox,* one of the few species of ground-living agarics which starts fruiting in early summer.

The predominance of plant parasites amongst the 17 species of microfungi identified is a reflection of the interests of the people present. Although the leaves of spring-growing plants were fading, the bluebell rust *Uromyces muscari* on *Hyacinthoides non-scripta* and the smuts *Entyloma ficariae* on *Ranunculus ficaria* and *Urocystis anemones* on *Anemone nemorosa* were still evident in the woodland. Another common spring rust *Puccinia tumida* was detected on old leaves of *Conopodium majus,* which was flowering abundantly in the meadow. Also present in the woodland was the fern rust *Milesina kriegeriana* on *Dryopteris dilatata,* growing on overwintered, drying and collapsed fronds (as described by Chris Yeates, *Bulletin* **35**: 24 [2001]). Many herbaceous plants were growing rapidly and the most striking microfungi were those parasites which systemically extend inside their living hosts, infecting whole shoots, notably the rust *Puccinia betonicae* abundant on *Stachys officinalis* in the meadow. Other systemically growing species recorded were the rusts *Puccinia punctiformis* on *Cirsium arvense, P. pulverulenta* on *Epilobium hirsutum,* and the downy mildew *Peronospora ranunculi* on *Ranunculus repens.* The anamorph (asexual stage) of *Monilinia johnstonii* was widespread on dying leaves of *Crataegus.* In Yorkshire the sexual fruit bodies of this ascomycete have been recorded on fallen fruits of *Crataegus* in spring.

Lichenology (A. Henderson)

The walls of the farm office and reception block had a liberal coating of about 30 lichen species forming a muted mosaic of expected species, *Caloplaca decipiens, C. flavescens* and *C. saxicola* imparting a distinctive note of yellow-gold here and there, with white *Diplotomma alboatrum* and *Toninia aromatica* notable among the general grey and whitish greens of the background crusts.

Ash, Elder and Oak about the farm produced only a small number of species. Willows carried an expected initial assemblage of nitrophilous colonisers, a *Xanthorion-Physcietum* of a dozen or so species. The most intriguing tree by far was an old Ash by the pond on the approach to the farm from the south, which had bright yellow-green expanses of *Calicium viride* with its dark-stalked pinhead fruits; near the base of the bole were thin flaking crusts of the no doubt often overlooked *Caloplaca obscurella,* here unusually fruiting.

WYKEHAM LAKES, (VC62) 7 July 2001

Introduction (J. M. Blackburn)

A party of 14 assembled in the car park at Wykeham Lakes with the permission of the

Wykeham and Danby Trust. The weather was warm and sunny. This venue was substituted for the one intended on Castle Howard Estate which had to be cancelled owing to the foot and mouth outbreak. The area has a series of landscaped lakes, formerly gravel pits, though part of the site is still being worked. The lakes are used for carp, trout and pike fishing, with a horse-shoe shaped lake used in competitions, and the most southerly lake set aside for water sports. The area contains some natural woodland. Much of the soil is sandy but with a good covering of peaty soil in places, sufficient to provide a variety of habitats in addition to the lakeside environment with its well-established flora and fauna.

The tea and reports meeting held in Brompton Village Hall was attended by 12 members representing 10 affiliated societies, and was chaired by the President, Dr Gillian Brand.

Mammals and Lower Vertebrates

Common Frog, Toad (tadpoles), Mole, Rabbit and Weasel were seen during the day. Les Magee commented that Otters, reported occasionally, are also noted near to trout farms in other parts of the north-east, mostly as casualties.

Ornithology (J. A. Newbould)

Skylark was heard all morning in the north-east of the area, and also in the marshy area adjacent to alder by a ditch, where Sedge Warbler was present. Up to five Mute Swans flew between the pools during the day and a pair of Oyster-catchers was heard calling. The Pike Lake had breeding Coot, a small flock of Grey Lag Geese, Swift, a single Heron and Little Grebe. Chaffinch and Blackbird were associated with the hedges and Magpie and Feral Pigeon were seen in the wooded area. Moorhen was also present on open water.

Lepidoptera (J. Payne)

A good selection of lepidoptera was seen. Seven species of butterfly were recorded mainly as singles; one Large Skipper and numerous Small Skippers were flying in the rough area near the Horse-shoe Pond. Many Ringlets and a few Meadow Browns were in the same location. A Red Admiral and a Painted Lady were reported. A full-grown larva of Peacock was found. A Large White was flying in the car park.

Nine geometrid moths were captured, mainly in the glades among the bushes surrounding the fishing ponds. Sandy Carpet and Dingy Shell were the rarest. Most of the others were more common 'waves' and 'carpets'.

The showy red and black Cinnabar was flying, and both the yellow and black striped larvae and the tightly packed ova were seen on the food plant, Ragwort. A very small Hawk Moth larva was found, probably Eyed Hawk but too small for certain identification. The only noctuid seen was Silver Y, though a green and white larva has been bred out and is Dusky Sallow (*Eremobia ochroleuca*). A few 'micros' were named. The work of *Limnaecia phragmitella* was noted on Reed Mace growing in the water. *Agapeta hamana*, a yellow member of the *Tortricidae*, was beaten from the bushes, as was *Pyrausta olivalis*, a rather large 'micro'.

The longhorn *Nemophora degeerella* was flying in the woodland. The male of this spectacular, tiny moth has antennae up to 10x its body length.

Coleoptera (W. R. Dolling & F. E. Kenington)

After the briefing and warning to steer clear of fly fishermen, collecting commenced in the vicinity of the Horse-shoe Pond. Five species of Elateridae (click beetle) were obtained from the edges of the field; W.R.D. took *Hemicrepidius hirtus* and *Agriotes pallidulus* and *Kibunea minuta*; *Agriotes acuminatus* and *Dalopius marginatus* were found by F.E.K. The Tortoise Beetle *Cassida rubiginosa* was swept from thistles. W.R.D. found a variation of *Adelia decempunctata*, large, bright red and heavily spotted (12 spots including a big, shared, heart-shaped one in the middle of the elytra).

Under a beech leaf, W.R.D. had the find of the day, *Prionocyphon serraticornis*, a Notable B species associated with wet or water-filled tree-rot holes in ancient broad-leaved

woodland or pasture-woodland; the larva is probably predatory on flies (Diptera) and other larvae that live in rot-holes.

Adjacent to the south-east lake a winding channel had been dug through the reedbed. Most of the channel was dry, but one or two deeper sections still held water. One, *c.*6 m^2 in extent, with a maximum depth of *c.*30 cm, contained eight species of water beetle: *Colymbetes fuscus, Ilybius fuliginosus, Agabus bipustulatus* (common), *A. sturmi, Hydroporus palustris, Laccobius minutus, Helephorus grandis* and *H. brevipalpus*. No beetles were seen in the other lakes, but *Laccobius minutus* at the edge of the Horseshoe Pond, along with *Haliplus confinis* and *Laddophilus hyalinus*, was found by W.R.D. The insect fauna of the lakes is poor in species and individuals of air-breathing groups, perhaps because they are easy for fish to see against the sky when they visit the surface. In view of the richness of a pool found by F.E.K., it may be worth suggesting that the estate digs very small groundwater ponds to provide fish-free habitats for invertebrates.

Four species of Apion weevils were found, i.e. *Protapium dichroum* and *Perapion curtirostre* on White Clover and *P. violaceum* and *Ischnopterapion virens* on Dock. Only one ground beetle, the common *Dromius linearis*, was found. In all, 47 species were recorded, lower than a usual total of around 60.

ENTOMOLOGY (W. R. Dolling)

Orthopteroid species seen were *Forficularia auricularia* (Common Earwig), *Tetrix undulata* (Common Groundhopper) and *Omocestus viridulus* (Common Green Grasshopper). Neuropteroid taxa were *Panorpa* (Scorpionfly, frequent but unidentified to species level), *Nineta flava*, a large Green Lacewing, and *Hemerobius stigma*, a small Brown Lacewing.

Hemipteran species seen were immature Gerris water bugs and three Water Boatmen (Corixidae): *Sigara distincta, S. dorsalis*, and *S. falleni*.

Sycamore had abundant hemipterous insects: the aphid *Drepanosiphum platanoidis* and three leaf-hoppers, *Ossiannilssonola callosa, Fagocyba cruenta* and *Eurhadina loewii*, the last of these not yet adult but readily identifiable in immature stages by its striking colour pattern. Sycamore has settled nicely into the British woodland flora, is more resistant to exposure and pollution than many native trees and has acquired a substantial insect fauna of considerable importance to insectivorous invertebrates as well as birds. *Drepanosiphum platanoidis*, however, showers honeydew onto parked cars below to which dust sticks.

Grass-feeding bugs found were: two planthoppers (Delphacidae), *Kosswigianella exigua* and *Criomorphus albomarginatus*; five leafhoppers (Cicadellidae), *Eucelis plebejus, Errastunus ocellaris, Psamnotettix confinis, Macrosteles viridigriseus* and *Eupelix curpidata*; and nine grassbugs (Heteroptera, Miridae, Stenodemini), *Pithanus maerkeli, Acetropis gimmerthali, Stenodema calcaratum, S. laevigatum, Notostira elongata, Megaloceraea recticornis, Trigonotylus ruficornis, Leptopterna dolabrata* and *L. ferrugata*. *Acetropis gimmerthali* is probably a new VC62 record and certainly a local rarity at its northern limit.

Unsurprisingly, as VC62 is rather poorly worked for Hemiptera, a planthopper on *Phragmites, Chloriona unicolor* was apparently new for North East Yorkshire. *Capsus ater*, a grass feeder, and *Conomelus anceps*, feeding on rushes, were recorded; also seen were: (Lygaeidae) *Cymus* sp. (probably *C. glandicolor* but immature), *Scolopostethus thomsoni* feeding mainly on fallen nettle seed, and *Chilacis typhae* feeding on *Typha* seed, usually while still in the seed-head; (Anthocoridae) *Anthocoris nemorum*, the only member of its family found; (Nabidae) *Nabis flavomarginatus*, the only adult Heteropteran occurring; (Miridae) *Calocoris norwegicus, C. stysi, Lygus rugulipennis, Lygocoris pabulinus, Polymerus nigritus* (usually on Cleavers but here on Crosswort), *Plagiognathus arbustorum, P. chrysanthemi, Psallus ambiguus, P. diminutus, Mecomma ambulans, Heterotoma planicornis, Orthotylus marginalis, Monalocoris filicis* (on Bracken and less frequently on *Dryopteris dilatata*) and *Bryocoris pteridis* (on *Dryopteris dilatata*); and (Saldidae) *Saldula saltatoria*. Further records were: (Cercopidae) *Philaenus spumarius,*

Neophilaenus lineatus and *Aphrophora alni*; (Cicadellidae) *Oncopsis tristis, Eupteryx urticae, E. vittata* and *Ribautiana ulmi*; (Cixiidae) *Cixius nervosus* and *Tachycixius pilosus*; (Psyllidae) *Psylla alni* (the largest British psyllid, on Alder) and (Diaspididae) *Chionaspis salicis* on the trunk of a small Ash.

Diptera noted were *Pachygaster atra, Nemotelus nigrinus*, and *Urophora stylata* on Spear Thistle where the larvae make a woody gall in the capitulum; *Chrysopilus aureus* was also seen. An adult female of *Criomorphus albomarginatus* (mentioned above) was parasitised by *Elenchus tenuicornis* (Strepsiptera, usually reckoned to be aberrant Coleoptera).

Plant Galls (K. G. Payne)

Six species were noted. Pustules of Eriophyid mites were caused by *Phytoptus sorbi* on Rowan leaves, by *P. laevis laevis* on Alder leaves (abundantly and randomly distributed), by *Eriophyes pseudoplatani erinea* below Sycamore leaves, and *Cecidiophyes galii* distorting stems and leaves of Goosegrass.

The Gall Midge *Iteomyia major* caused swellings along the midribs of *Salix* (probably *S. cinerea*) leaves and the Anthomyid fly *Chirozia betuleti* caused knotting galls on Broad Buckler Fern.

Botany (J. G. Lambert)

In the woodland *Mycelis muralis* was abundant in places. *Hypericum hirsutum*, *Elymus caninus* and, in the shadier parts, *Oxalis acetosella*, also occurred. One plant of *Sanicula europaea* was found by Dr Gillian Brand. *Mercurialis perennis* was under beech away from the main woodland and also growing amongst *Phragmites* on the lake shore.

The marshy areas were perhaps the most interesting habitats with some good stands of *Phragmites communis* and with some parts dominated by *Juncus* spp. in which some *Isolepis setacea* also occurred. *Lycopus europaeus, Hypericum terapterum* and *Scrophularia auriculata* were also typical species. John Blackburn noted *Lysimachia nummularia* and, in grassland, *Carex spicata*. *Hippuris vulgaris,* sometimes introduced by anglers, was in more open water.

In the drier, less shaded areas there was *Odontites vernus* and a fine show of *Centaurium erythraea,* and, in the longer vegetation, *Dactylorhiza fuchsii*. *Carex demissa* was by the lake edge.

Plant Communities (J. A. Newbould)

The revised O.S. (1:25,000) map of 1981 shows the area as Ings Plantation, a large stretch of flat, mixed woodland at 26 m AOD. A series of fishing lakes and a leisure area have since been established, following sand and gravel extraction. The general area, south of the North Yorkshire Moors National Park and sloping gently towards the Derwent 1 km to the east, is criss-crossed by abundant drains with names such as Hutton Buscel Carr and Ings Gate. Significantly, the villages of Hutton Buscel and Wykeham are established on higher ground to the north.

Much of the morning was spent in the north-east area of the former Ings Plantation. To the west of Heads Drain is a hedge with *Malus sylvestris* as its principal bush, some *Sambucus nigra* and *Fraxinus excelsior,* whilst *Crataegus monogyna* represented only 10% of a 20 m strip. Immediately to the south another ditch had a very old coppiced Ash and a 20 m strip was composed of *Rubus fruticosus* (Domin 4), *Rosa canina* (Domin 5), two very old *Alnus glutinosa* (Domin 5), a single Hawthorn (Domin 4) and three Ash (Domin 5). With no dominant component in these hedges, it is difficult to assign a National Vegetation Classification, but W21 Hawthorn-Ivy is the most appropriate, leading to MG1 False Oatgrass-dominated grassland. There are no woodland herbs with the exception of *Glechoma hederacea*. Adjacent to the hedges is a retaining bank, formed from spoil excavated in making a small pool. Plants covering the bank resemble the MG10 Holco-Juncetum rush-pasture. *Carex ovalis, C. hirta* and four species of rush were present.

Nearby, on the west side of a pasture south-east of the farm buildings at Charm Park, an old hedge was composed of Crab Apple, Hawthorn and Elder. It had been layered but in a strange way, best described as low pollarding, many years ago, and is presently managed to three metres. The meadow to the east was improved *Lolium* grassland. The large fields to the east, associated with Darrell's Low Farm were typical modern fenland fields, drained by steep-sided drains and devoted to arable production.

Bryophytes (J. M. Blackburn)

The deciduous woodland behind the fishing cabin was examined first. This had a peaty soil supporting *Atrichum undulatum, Dicranella heteromalla, Eurhynchium striatum, Fissidens taxifolius, Mnium hornum, Plagiomnium rostratum, P. undulatum, Pseudotaxiphyllum elegans, Rhynchostegium confertum* and, on stones, *R. murale*. A dry ditch on the northern edge of the wood had *Fissidens bryoides, Conocephalum conicum, Lunularia cruciata*, and *Pellia epiphylla*. Due to the prevalence of Sycamore in the wood, epiphytes were scarce, but *Dicranoweisia cirrata, Hypnum cupressiforme, H. resupinatum, Orthodontium lineare* and *Orthotrichum diaphanum* were seen. Dead wood had been left in place and this produced large quantities of *Aulacomnium androgynum*, with their 'drum-sticks' of gemmae clusters. It shared this habitat with *Campylopus introflexus, Lophocolea bidentata* and *L. heterophylla. Riccia sorocarpa* was seen on bare soil in places. The site revealed four species of *Dicranella*: *D. heteromalla, D. schreberiana* and *D. staphylina* were found on sandy soil and *D. cerviculata*, with the conspicuous struma at the base of the capsule, was on peaty soil by Horseshoe Lake. Peaty soil in a damp open area produced *Dicranum scoparium* and *Pleuridium acuminatum*. More grassy places had *Brachythecium rutabulum, Eurhynchium praelongum, Scleropodium purum* and *Rhytidiadelphus squarrosus*. All the common ruderals were found on bare ground around the car park and track-sides. In all, 55 species were found.

Mycology (J. O. K. Webb)

A fresh breeze, which persisted throughout most of the day, did not improve the already dry conditions at this "water-sports paradise". Nevertheless, 50 species were collected, along with 7 myxomycetes (a figure expected to be improved upon when the various barks collected produce fruit).

Gillian Brand and her husband found two unusual rusts: *Protomyces pachydermis* on *Taraxacum officinale* (which despite Ellis's claim that it is common, does not appear in the Bramley *Flora*) and *Puccinia difformis* found on an uncommon host, *Galium aparine* (also absent from Bramley). The find of the day, awaiting confirmation, is thought to be the myxomycete *Didymium perforatum*, according to the BMS *Census Catalogue 2000* only found once before in the British Isles, in VC 100.

Lichenology (A. Henderson)

The lichen flora of the study area had a low biodiversity, with a *Parmelietum* on trees no further developed than occasional *Evernia prunastri* and a few small thalli of *Ramalina farinacea*, accompanied by an invading *Xanthorion-Physcietum*, doubtless a response to the overall nitrogenous agricultural ambience, typified by the presence on an old Ash by the Horseshoe Lake of some of the most prolifically fruiting and hooded *Physcia adscendens* one might hope to see anywhere. The most well-developed lichen assemblages were on old drystone walling, which yielded 20 of the 36 species recorded during the day.

Freshwater Ecology (L. Magee)

Wykeham Lakes, *c.*1 km south of the Pickering/Scarborough road, consist of several landscaped amenity lakes whose construction commenced about 20 years ago, on the site of former sand and gravel workings. A semicircular canal-type lake, the Horseshoe Lake, has been recently constructed close to the Derwent. The whole site, on carr land *c.*30 m above sea level, is soil type Altcarr 1022p (wet land over deep peat). The Trout Lake and

the Causeway Lake are screened by a belt of trees, mainly Willow species, Alder and Birch. There is an interesting marginal and bog flora and a number of rare aquatic plants; the stoneworts are notable. No alien aquatic plants were observed during the visit. The lakes are noted for both resident and visiting bird populations, with more than 170 species having been recorded. The resident birds are not unduly disturbed by the anglers. Only about 50% of the area was available during the meeting, but members of the Freshwater Section make regular visits.

The Trout Lake (SE 98288282) is fed from a piped supply at the north end which can be regulated to give a fairly constant supply of oxygenated water (pH 7.6). *Aeshna grandis* the Brown Hawker Dragonfly is occasional. *Enallagma cyanthigerum* the Common Blue and *Ishnura elegans* the Blue-tailed Damselfly are frequent, *Sympetrum striolatum* occasional.

The Horseshoe Lake has the above species plus *Coenagrion puella* the Variable Blue Damselfly and the Mayflies *Cloeon simile* The Lake Olive, *Caenis horaria* and *C. luctuosa*, members of a genus known as the Angler's Curse. Very few adult Caddis were seen and only a small number of larvae were captured. However, much of the water is too deep for wading. An adult *Phryganea grandis*, one of our largest species, was seen on the surface but ignored by the trout. Anglers reported a large evening emergence of adults. The Freshwater Shrimp *Gammarus pulex* was abundant. The lakes are noted for the emergence of huge numbers of Chironomid species. These have not been fully investigated, but several of the larger species are uncommon in Yorkshire.

The Pondweed *Potamogeton pusillus*, which is very local in Yorkshire and uncommon in north-east and east Yorkshire, has spread rapidly in the Horseshoe Lake and is present in all the lakes. *Myriophyllum spicatum* Spiked Water-milfoil, uncommon in the north-east, occurs in all the lakes with the rather more common *M. alterniflorum*. There are abundant beds of Stoneworts in the lakes. These have been identified by A. Henderson as *Chara rudis*, a very rare species, *C. vulgaris* var. *papillata*, *C. virgata*, and *C. hispida* var. *major.*

GOLDEN ACRE PARK, BREARY MARSH AND THE HOLLIES (VC64) July 21 2001

Introduction (A. Henderson)

19 members met in the car park at Golden Acre, most of whom elected to go with David Wooldridge of the Park staff, who guided us along the wooden walkways traversing the wettest areas of Breary Marsh. These wooden walks are now in a dilapidated condition here and there and are now normally closed to the public until they can be renovated. Most members followed the circular route round the pond to the south, and then headed back towards the Park, Adel Dam Reserve and Adel Bog. Mr Magee spent a most fruitful day studying the freshwater ecology of the Meanwood Valley in the area of the Hollies.

The tea and reports meeting were held in the Park's nursery office building. A vote of thanks was given to the Park staff for the hospitality provided and for the provision of information and guidance during the day. We were particularly grateful for the opportunity given us to visit such an extensive choice of habitats at such short notice in a year so beset by the exigencies of the foot-and-mouth epidemic.

Lepidoptera (J. Payne)

Scarcely any moths were seen, nor were any larvae noted, from the board-walk through Breary Marsh and the adjoining woodland to Paul's Pond in the morning.

In Golden Acre Park, in the afternoon, butterflies were flying mainly in the glades between the shrubs and trees where flowers were growing wild. A patch of Field Thistles was a great attraction, as also was flowering Bird's foot Trefoil and Ragwort. Meadow Brown was the commonest species followed by Small Heath and Small Skipper. A few Ringlets were at the thistles together with a couple of Small Tortoiseshells, a Gatekeeper and a Small White. Some Small Heaths were a very pale colour on the upper side.

There was much *Verbascum* sp. flowering in the borders and naturalised in the wilder parts, but in spite of searching no evidence of Mullein Moth larvae was found. Even more surprising no Cinnabar larvae were on the Ragwort (*Senecio jacobaea*) although it is recorded from SE42 (cf. Wykeham a fortnight earlier when ova, larvae and imago were all seen).

Plant Galls (J. & K. G. Payne)
Galls of 10 common species were collected by J.P. Of particular interest was that the hairy, cylindrical, upper-side galls caused by the midge *Hartigiola annulipes* on beech leaves collected by Paul's Pond were ready to fall off, though this does not normally take place until August/September.

A young walnut tree in the grounds of Golden Acre Park showed the conspicuous large blister galls of *Eriophyes erineus*.

Botany (D. R. Grant & P. P. Abbott)
This valley, situated on the Millstone Grit series of rocks, has been a mecca for naturalists for over a century. The stream arises near the airport and flows south-east to Leeds city centre. The soils are very acid with colonies of *Calluna vulgaris* in parts. The woodland is predominantly Birch-Sessile Oak, with *Sorbus aucuparia*. Members were conducted round the Breary Marsh area where there is a large colony of *Carex paniculata*. Many species typical of marshes grow here together with *Menyanthes trifoliata*. In an adjacent field there were many spikes of Common Spotted Orchid *Dactylorhiza fuchsii*. At Paul's Pond *Potamogeton obtusifolius* was collected, also *Rubus echinatoides*. *Nuphar lutea* also grows here. A few members visited the YWT Reserve at Adel Dam where the presence of two colonies of the rare bramble *Rubus schiocharis*, found in the 1970s by the late Florence Houseman, was confirmed. After lunch the botanists explored the lower part of the valley to see Adel Bog, an area rich in bramble species: *Rubus scissus, R. plicatus* and *R. bertramii* (known only from two sites in Yorkshire) occur on the drier open parts; other areas have *R. sprengelii, R. mucronulatus, R. newbouldii* and *R. anisacanthos*, and in one of the tracks the uncommon Slender Trefoil *Trifolium micranthum*. By the side of the stream *Carex pendula, C. remota* and *Cardamine amara* occur. Adel Bog is still a wet area with much *Molinia caerulea,* but has *Narthecium ossifragum* and *Scutellaria minor*. The Lesser Skullcap has been known for over a century; it still grows (as stated in Lee's *Flora of the West Riding*, 1888) in the south eastern corner of Adel Bog. Some of the scrub shading it was pruned in an attempt to aid recovery.

Janetta Lambert commented that *Sphagnum* moss, noticed at Adel Dam in 1993, was not observed at the YWT Reserve on this occasion, but was seen on approaching Adel Bog.

Mycology (G. M. Brand and A. W. Brand)
It was interesting to record 19 species of larger basidiomycete fungi at this time of year. Two agarics, sent to Roy Watling, have been determined as: *Bolbitius aleuriatus* (several records in Bramley as *Pluteolus aleuriatus*) and the uncommon *Inocybe acuta* (a first Yorkshire record). It was good to see large, probably over 10 years old, fruit bodies of *Phellinus igniarius* at Adel Dam (var. *igniarius* of Bramley), as this is dependent on large, old *Salix* trees.

The list of microfungi reflects our concentration on leaves. The most interesting find was the little discomycete *Leptotrochila cerastiorum* on chickweed. Our only previous personal find of this was in the car park at High Batts Nature Reserve. Could there be a causal connection with mown grass? 43 taxa were recorded during the day.

Lichenology (A. Henderson)
The handrails of the wooden walkways through the marsh bore the black umbonate fruits of *Micarea lignaria*, accompanied here and there by scarlet-fruiting *Cladonia macilenta* on a typical duller lignicolous background of *Trapeliopsis granulosa, Placynthiella icmalea*

and *Lecanora conizaeoides*, the last species now much less prevalent and vigorous as a result of the decline in atmospheric SO_2 levels. Shaded sandstone along the woodland edges yielded some shrubby thalli of *Ramalina farinacea* and *Evernia prunastri*. Newly invading *Lecanora chlarotera* was beginning to fruit here. Much less easily seen was crustose *Bacidia arnoldiana* low down on shaded tree boles and buttress roots.

Around the pond to the south, sandstone edging had over a score of species with a striking 30-70% cover of *Lecanora muralis* (often *forma diffracta*), evidently a response to the heavy eutrophication of the area from the activity of birds and their incidental transport of propagules *via* body attachment and excretion. The roadside coping community (20 species) on the way back to the Park was dominated by *Porpidia crustulata, P. macrocarpa* and *P. tuberculosa*, with *Protoblastenia rupestris* favouring the neighbourhood of interstitial mortar.

The lichens in the Park itself were in general such as any Leeds semi-rural suburb might be expected to produce, although well developed *Aspicilia calcarea* and *Verrucaria hochstetteri* on imported limestone rockery were noticeable.

Trees on the south-western lakeside had a developed *Parmelietum* with *Hypogymnia physodes, H. tubulosa* and *Everna prunastri*. The sole apple tree in the Park hosted a flora of 16 species, including the uncommon brown *Parmelia exasperata* and the microspecies *Lecania cyrtella* and, usually shrouded in algae, *Scoliciosporum chlorococcum*.

The overall impression was that many of the parkland lichens are newly invading in the wake of declining atmospheric SO_2, although those of old walls and copings appear to be the continuation of an older flora. Altogether 60 species were recorded during the day.

Freshwater Ecology (L. Magee)

Surprisingly, during this meeting, the writer was the only member to visit the Hollies area so well known to members of the Union in past years.

The Hollies is an Edwardian estate and property situated in the suburb of Meanwood and is under the control of Leeds City Council. The site consists of the grounds of the Mansion and the steep sided sandstone valley, in all consisting of around 30 acres. There are steep zigzag paths, popular with local walkers, leading down to the stream and the Meanwood Valley Trail. There are many large oaks and the alders are exceptionally fine. The woodland gardens on the slopes are somewhat neglected and in some areas Indian Balsam is invading from neighbouring land. There is a fine collection of exotic shrubs and plants, mainly of Far Eastern origin. There are many small springs which create damp areas and which flow down to the Canal (Goyt) or to the stream itself. The route and sites surveyed were recorded using a Magellan GPR receiver. Surveying began at the Hollies car park (SE 2762 3778) and proceeded through the parkland and the woods, sampling the stream as far as the Leeds Ring Road.

The main stream had an average pH value of 7.0 and a total hardness of 80. There was a strong smell of ammonia throughout its length, and the reason was later apparent when a large notice board near the ring road announced that the stream may be polluted with raw sewage. The canal was shallow with a bed of silt and decaying leaves. It was virtually devoid of invertebrates apart from *Asellus aquaticus*. However, local children had collected a dozen Great Crested Newts from a nearby pool, which were released. Two small Brown Trout were seen upstream of the weir pool and a Dipper was reported to have reared young upstream of the ring road during May.

There were very fine plants of *Carex pendula* in wet places, a plant mostly introduced in the Leeds area and in Wharfedale; *Symphytum tuberosum* is well established; *Impatiens glandulifera* is invading the slopes from neighbouring land; *Polystichum aculeatum* is an introduction; there are some very fine colonies of *Oenanthe crocata*, for which the Valley has long been noted. More than 60 species of native marginal plants were recorded near to springs and boggy areas close to the main stream. The only true aquatics found were *Sparganium erectum, Fontinalis antipyretica* (moss) and *Oedogonium* and *Cladophora* species (algae).

CANNON HALL COUNTRY PARK, (VC63) 11 August 2001

INTRODUCTION **(J. Coldwell & A. Henderson)**

Situated amid a particularly attractive Coal Measures landscape, Cannon with its adjacent parkland ("*an oasis of pleasant, unspoilt countryside in a district scarred by industrial development*", as Lloyd-Evans put it in his 1974 Presidential Address) is a somewhat underworked locality, although the surrounding woodlands have to a certain extent attracted the attentions of naturalists down the years: see, for example, Cheetham's useful list of flies from nearby Deffer Wood in 1928 on the occasion of the 342nd meeting of the YNU.

At the present meeting an impressive cross-section of interests was declared as 21 members and 7 visitors assembled, and a good range of habitats was subsequently explored in pleasant if rather overcast conditions.

The tea and reports meeting, with 20 people in attendance representing 13 affiliated societies, was taken in the Field Centre meeting rooms where considerable attention was paid to a large and most impressive glass bead portrait in the Landseer style, something of a rarity, obtained for the Cannon Hall collection in 1970 from the mansion of a Bramley, Leeds, factory owner on the demolition of his property. A vote of thanks to the Museum and Barnsley Council for their hospitality rounded off the day's proceedings.

ORNITHOLOGY (J. E. Dale)

The area around Cawthorne village and the woodland complex immediately to the north annually holds about 60 breeding species, thus the day's total of 38 was rather less than had been anticipated.

The sight of a Common Buzzard soaring over Margery Wood just before midday was of real interest, and augers well for the future. A Sparrowhawk was over the same woodland shortly afterwards. Common Buzzard breeding populations in the neighbouring counties of Lincolnshire, Nottinghamshire and Derbyshire have become well established in the last ten years, and fit into a general pattern of increase in eastern Britain since the 1980s. Breeding has recently been proved near Doncaster with birds present at one site since 1995, and further pairs are now becoming established in South Yorkshire.

In the gardens around Cannon Hall, Collared Dove (14), Song Thrush and Goldcrest were present, and at least four Nuthatch were heard. The last species has bred in these gardens for about ten years, and has established itself in numerous sites in South and West Yorkshire, particularly since 1975. Of summer visitors, up to 20 House Martins were feeding over Cawthorne; over 30 Swallows were more widely scattered; three Sand Martins were noted over the lakes; and Swifts were seen intermittently. Otherwise only Willow Warblers (up to ten) were located in hedgerows and dense vegetation. Chaffinch, Greenfinch and Goldfinch were present in good numbers, with family parties of the latter two noted on several occasions.

A visit to the southern part of Deffer Wood in the afternoon only added Coal Tit and Bullfinch (single figure parties of both) to the list, but tree growth here is very dense and time for searching was limited.

LEPIDOPTERA (H. E. Beaumont)

Recording was confined to the park in the vicinity of the lakes and of the hall itself. The grounds were well manicured and the vegetation adjacent to the lakes well grazed by the resident flock of Canada Geese. Despite this, nine species of butterfly were seen including *Polygonia c-album* Comma, *Pyronia tithonus* Gatekeeper and several *Lasiommata megera* Wall. The most notable of the adult moths seen was a single *Nycteola revayana* Oak Nycteoline, while a search for immature stages revealed larvae of *Orgyia antiqua* Vapourer, larval mines of *Leucoptera laburnella* on laburnum and larval cones of *Caloptilia rufipennella* on sycamore. The latter is a relatively recent addition to the Yorkshire fauna which is now well established and quite widely recorded.

COLEOPTERA (M. L. Denton)

The coleopterists present spent the day searching the edges of the lakes and a small clump of Scotch Pines on the lawn near the car park. Well manicured lawns are not the best habitat for any insect order, but the grass cuttings which had escaped the mower did provide a much needed micro-habitat for a number of species. The ten species of Staphylinidae and six Latridiidae were all commonly encountered species, however, and to be expected in such a medium. Two examples of the locally distributed Staphylinid *Atheta malleus* were found running on the mud along the lake edge. Although the species is widely distributed in this type of habitat, it is surprising how a population continues to exist at Cannon Hall when one considers the amount of puddling the exposed mud has to endure from the local Canada Goose population!

A bracket fungus on a dying Sycamore along the lake edge only harboured *Atheta crassicornis* and *Mycetophagus quadripustulatus*. Examples of the yellow and black longhorn *Rutpela maculata* were located on umbellifers on both sides of the lake, as were specimens of the museum beetle *Anthrenus fuscus*. This later mentioned species is the only member of the genus that is normally found out of doors; the others being synanthropic. The Tenebrionid, *Lagria hirta*, common nationally, more localised in the north, was swept from the lakeside vegetation. *Henoticus serratus* was located in old fungi on cut logs on the south side of the lake. This locally distributed species is associated with bracket fungi in old woodland, there being 15 widely distributed Yorkshire records.

The small clump of Scotch Pine produced two interesting species, *Ernobius mollis* and *Myrrha 18-guttata. E. mollis*, although the commonest member of the genus in Britain, has only been recorded in Yorkshire from 26 localities (only seven records are post-1980, one of these being from Deffer Wood on 2 August 1981). The ladybird *M. 18-guttata,* usually found on conifers where it feeds on aphids, is widely distributed in Yorkshire, but not commonly encountered.

Despite the lateness of the visit, a total of only 107 beetle species were recorded.

ODONATA (J. Lucas)

The meeting at Cannon Hall was very disappointing for the Odonatists. The number of geese, and consequent pollution of the water, were not conducive to either numbers of insects or variety of species, nothing noteworthy being recorded.

DIPTERA (J. Coldwell)

Several members collected Diptera, but the writer directed his attentions to the damp wooded areas near the cricket field where, amongst a common array of fungus-gnats, two scarcer species, *Mycetophila tridentate* and *Phronia coritanica*, were new to the district. Dennis Giggal's capture of the dark-winged conopid *Conops strigata* was perhaps the highlight of the day, whilst Gavin Boyd was no less pleased to obtain the picture-winged fly *Chaetostomella cylindrica* around Knapweed and the late summer soldier-fly *Beris morrisii*. The handsome dolichopid *Poecilobothrus nobilitatus* was abundant around the margins of the lakes. In the same situation the pretty tephrid *Tephritis cometa* was found, a species at the northern edge of its range in south Yorkshire. The winged hippoboscid *Ornithomya avicularia* was found in the writer's net just inside the garden area of Cannon Hall, a species last reported for the district at nearby Kexborough by E.G. Bayford in the *Victoria History of the County of York.*

A specimen, later identified as *Tricholauxania praeusta* was taken by Gavin Boyd.

ENTOMOLOGY (D. G. Hemingway)

The entomology was, perhaps typically for this time of year, rather restricted, but a few species of interest merit mention. A small area of pine situated west of the main car park was worked and a number of invertebrates taken from beneath sheets of bark. These included: (single examples of the spiders) *Amarobius ferox* and *Segestria senoculata* and, typically, many examples of the Window Spider *Amarobius fenestralis*; but, surprisingly, a

very large number of 'woolly bears', these being the larvae of Dermestid beetles. Six ladybird species were recorded by beating pine branches: the ubiquitous *Coccinella septempunctata, Adalia bipunctata* and *A. decempunctata*, but also the more interesting species, *Calvia 14-guttata, Myrrha 18-guttata* and *Aphidecta obliterata*. In addition a spectular example of a female cross spider *Araneus diadematus* was beaten from the pines, raising a startled response from one of the ladies when passed round at the subsequent tea and reports meeting.

Jill Lucas took a single gall from oak, produced by the cecidomyiid fly (gall midge) *Macrodeplosis dryobaea*.

Botany (D. R. Grant)

Cannon Hall Country Park is situated on the Coal Measures series of rocks which are represented by fine grained sandstones and shales that give rise to mildly acidic soils. Members followed the shores of the lakes towards Cawthorne village. Marginal plants here were *Acorus calamus, Stachys palustris, Sparganium emersum, Eleocharis palustris* and *Bidens tripartitus*. There were large stands of *Nuphar lutea* on the last lake. The hedgerow near the cricket ground had *Acer campestre, Brachypodium sylvaticum* and *Rubus warrenii*. The footpath was then taken up to the western part of Margery Wood. This is an old wood with some very old specimens of *Quercus petraea*. The woodland has large colonies of *Rubus hylocharis* and *R. rufescens* together with *R. newbouldii*. The ride edges had *Rosa arvensis, Circaea lutetiana* and *Melica uniflora*. The eastern part of the wood was not visited due to time limits. This area has *Carex pendula, Euonymus europaeus* and *Hordelymus europaeus.*

Mycology (G. Brand)

The most striking-looking fungus found during the day was *Inonotus hispidus*. Three large tiered brackets in prime condition were seen 20 feet up a hedgerow ash tree below Margery Wood. This fungus is more commonly seen as persistent blackened 'corpses' after the brackets have fallen to the ground. A little parasol-shaped fungus *Coprinus plicatilis* was widespread on slurry-treated rye grass; clover fields and a large dung heap provided the habitat for three other agarics, *Coprinus cinereus, C. cothurnatus* and *Conocybe rickenii*. In Margery Wood the unique smell of the stinkhorn *Phallus impudicus* signalled its presence in several places, later confirmed visually. Only one mycorrhizal species, *Laccaria laccata,* was recorded, the other ten species of larger basidiomycetes being decomposer fungi. Of special interest was the uncommon *Flammulaster (Flocculina) carpophila*, a tiny agaric growing on fallen beech cupules. The sample of parasitic microfungi growing on flowering plants which was identified contained 16 species and included the ergot fungus *Claviceps purpurea* in which the purple horn-shaped sclerotium replaces the 'seed' of grasses (in this case *Lolium*).

Lichenology (A. Henderson)

The three lichenologists (A.H., C. J. B. Hitch and I. Instone) spent the first part of the morning studying the walls, buildings and ornamental stonework of the upper park. A sundial had *Porpidia tuberculosa, P. soredizodes, Rhizocarpon reductum, Lecidella scabra, Candelariella vitellina* and *Scoliciosporum umbrinum*, which with the addition of *Lecanora polytropa, L. intricata, Catillaria chalybeia, Verrucaria muralis, Acarospora fuscata, Lecanora expallens* and (in shady niches) *Psilolechia lucida*, were repeated in a variety of mosaics on much of the sandstone walls and ornamentation. The outer calcareous wall had a flora of 13 species, including *Diplotomma alboatrum, Leproloma vouauxii, Leprana lesdainii* and *Lecanora orosthea*. Wooden posts had profusely fruiting and pycnidiate *Micarea denigrata*.

The walled garden is the home of the Hall's historic pear tree collection, the trees dating back to the establishment of the garden in 1760. Today the garden has 49 pear trees and 7 apple trees with a vine and a few other fruit trees. Fan and espalier training has produced

horizontal and sloping branches, in places favouring a prolific lichen flora, if not one of great diversity: *Ramalina farinacea, Hypogymnia physodes, H. tubulosa*, and a *Xanthorion-Physcietum* including *Physcia dubia*. One apple tree had *Caloplaca obscurella* at its base. Brick walls here had *Trapelia coarctata, T. involuta* and *T. placodioides* growing in juxtaposition, and a little *Cladonia fimbriata*. This with *C. coniocraea* was surprisingly the only *Cladonia* seen during the day.

In the afternoon, lakeside trees in the lower park echoed the *Xanthorion-Physcietum* already seen: *Lecanora chlarotera* and *Melanelia subaurifera* were in considerable evidence. *Caloplaca phlogina* on the base of an old pollarded *Acer* about 10 ft from the water's edge was an unusual record here; originally considered to be a form of the very common *Caloplaca citrina*, this taxon is now accorded specific status.

A beech stump held *Lecanora carpinea*, and a wooden bench had both *Lecanora saligna* and *L. symmicta* along with *Physcia caesia*. Willow and Ash between the car park and lake supported the day's most diverse corticolous community: *Ramalina farinacea, Evernia prunastri, Hypogymnia physodes, H. tubulosa, Parmelia sulcata, Parmotrema chinense, Melanelia subaurifera, Physcia adscendens, P. tenella, P. caesia, P. aipolia, Phaeophyscia orbicularis, Xanthoria parietina, X. polycarpa, X. candelaria, Amandinea punctata, Lecania cyrtella, Lecanora carpinea, L. conizaeoides, L dispersa* and *Rinodina gennarii*.

The lichen flora, which has been subjected to notable pollution in the past, appears to be improving, as was shown by the discovery of *Physcia aipolia* on a tree by the car park. Records of this species, a recent addition to the flora of the West Yorkshire Conurbation, are becoming more frequent on a variety of smooth and soft barked trees. The day's list totalled 58 species.

BOOK REVIEW

Extinct Birds by **Errol Fuller**. Pp. 398, with many illustrations. 2000. Oxford University Press. £29.50 hardback.

Following the author's excellent monograph on the Great Auk (Oxford University Press, 1999), this book is as complete an account of avian extinctions as one could wish for. Each account includes the species name, its synonyms, a brief plumage description and measurements, together with details of the known history and fate.

The demise of many species is directly attributable to the hand of man and was accelerated by the mindless and short-sighted collecting of specimens; the scarcer they were, the more sought-after they became. The island faunas suffered the worst fate and the accounts make dismal reading. Fifteen families, including 85 species, are dealt with in great detail and include all the well-known extinct birds such as Aepyornis, Labrador Duck, Great Auk, Passenger Pigeon and Carolina Parakeet, in addition to many other less familiar; for example, the Pigeon Hollandais, so named because its colours of red, white and blue reminded its finder P. Sonnerat (1782) of the flag of Holland, inhabited the island of Mauritius, and J. Desjardins, a specimen dealer who spent part of his life there, left the only eye-witness account, claiming that individuals lived alone near riverbanks and fed on fruit and freshwater molluscs!

Specimens of some extinct species, many in poor condition, still exist in museums throughout the world and a few species are known only from such extant skins. The book, lavishly illustrated with photographs, drawings and paintings, is an excellent treatise crammed with fascinating details of this somewhat depressing aspect of ornithology.

JRM

AMPHIBIAN AND REPTILE REPORT, 2002

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This report summarizes the 2002 records of the nine species of herptile native to mainland Britain known to occur in Watsonian Yorkshire. In all, 288 records of eight species (but not Slow-worm) were received (Table 1). Copies of the full report have been deposited in Balne Lane Library, Wakefield and Doncaster Museum.

TABLE 1.
Summary of 2002 Herptile records for Yorkshire.

Common Name	**Latin Name**	**Number of Records Received in 2002**
Common Lizard	*Lacerta vivipara*	42
Adder	*Vipera berus*	4
Grass Snake	*Natrix natrix*	43
Common Frog	*Rana temporaria*	66
Common Toad	*Bufo bufo*	43
Great Crested Newt	*Triturus cristatus*	36
Smooth Newt	*Triturus vulgaris*	35
Palmate Newt	*Triturus helveticus*	19
Total		**288**

Common Lizard *Lacerta vivipara*

The Common Lizard appears to be widespread, but only locally common on moorland, lowland heath, wasteland and sunny rides and glades in woodland. However, due to the destruction of lowland heaths for agricultural improvement and afforestation and the abandonment of traditional management practices on heaths, it is considered to be only local in lowland Yorkshire.

The first record of a single seen at Skipwith Common (West) on 13 March, was followed by the sighting of another individual at the same site on 23 March. Hatched young were first recorded there on 27 July and a further two newborns, one without a tail, were recorded on 29 July. After late August the number of Common Lizards recorded rapidly declined, mirroring the decline in sightings of the Grass Snake. It was assumed that this was due to adults going into hibernation, although the last record was of a juvenile seen at Skipwith Common on 6 October. Adults were recorded at Skipwith Common, Allerthorpe Common, Wheldrake Wood and Goathland Moor, reflecting at least in part the authors' recording effort.

Slow-worm *Anguis fragilis*

From historical records the strongholds of this species appear to be the North Yorkshire Moors and parts of the Pennines, particularly Nidderdale and Wharfedale. Unfortunately no records were received for 2002, but this in part probably reflects the lack of recording effort.

Adder *Vipera berus*

This species appears to have been common and widespread throughout Yorkshire in the 19th century, but has declined in both numbers and range due to urban growth in South and

West Yorkshire and the loss of lowland heaths to agricultural improvement, afforestation and succession to woodland following the cessation of traditional management. The strongholds of this species are the North Yorkshire Moors, Thorne Moor and parts of the Pennines.

Two of the four records received for 2002 were from Allerthorpe Common, a site well known for the presence of this species. The first record was a sloughed skin found at Skipwith Common on 12 May by JM. Another sloughed skin was found at Allerthorpe Common on 16 May by RMS, followed by the sighting of an adult male at the same location by RMS on 19 May.

Grass Snake *Natrix natrix*

This was an excellent year for the Grass Snake with a total of 43 records, received almost exclusively from central and southern lowland Yorkshire, with Skipwith Common (Selby) and Campsall Country Park (Doncaster) providing the main source of records.

The first records were of two seen at Campsall Country Park on 24 April, followed by a single on 4 May, two on 21 May and a further four on 15 June, after which adults continued to be recorded throughout June, July and August. Sloughed skins were found at Potteric Carr Nature Reserve on 8 July and at Skipwith Common on 27 July, 29 July and 24 August. Sightings of adults became less frequent during September, suggesting that most adults were beginning to hibernate, despite warmer conditions than those they experienced on emergence in the spring. The number of records dropped from nine in August to two in September. The last record of an adult was at Skipwith Common (Central) on 26 October. At both Skipwith Common and Campsall Country Park a range of sizes in individuals was noted, indicating that both populations were breeding successfully. At Skipwith Common variations in the colour of individuals were noted, with a rather dark, melanistic specimen observed on 5 August.

On 5 October, 12 recently hatched young were seen amongst vegetation and leaf litter at the base of a south-facing brick wall of a former bomb-loading bay. The number of young recorded gradually increased, with 22 found on 13 October and 45 on the 19 October. The maximum number of young recorded at the site was 53 on 3 November (Mr J. Wollaston *pers.comm.*). During this month the number of young recorded gradually decreased, falling to 18, 12, 6 and 2 seen on 9, 17, 23 and 24 November respectively, when the weather was cold and foggy. The three young snakes seen were roughly in the same position as the previous day, suggesting that they lay exposed to the elements throughout the night; they were extremely sluggish but appeared to be slowly moving into cover. On 8 December a dead young Grass Snake was found at the same site; it had a puncture mark near its yellow collar and had probably been killed by a bird. The last record for 2002 was of a single young snake found at the same site on 14 December. The following week was very cold and foggy with severe frosts, bringing the recording season to a close.

Common Frog *Rana temporaria*

66 records of the Common Frog were received for 2002. Mild weather during late January stimulated early activity in this species, with a single adult being recorded at Wrenthorpe Meadows Top Ponds (Wakefield) on 29 January during a period of warm sunny weather. This was followed by a pair in amplexus recorded at the same site on 30 January. Low pressure systems, with temperatures of 10-12°C and westerly, sometimes gale force, winds, continued into February. However, despite frequent searching, frog-spawn was only first noted on 9 March, when 42 clumps of fresh spawn was seen at Wrenthorpe Meadows Lower Pond; three adults, 39 clumps of old spawn and 28 clumps of fresh spawn were recorded at Wrenthorpe Meadows Top Ponds. Throughout March spawn was regularly encountered in a variety of waters, particularly in the Wakefield area. The hatching out of frog-spawn was first noted in a garden pond at Lupset on 28 March, although fresh spawn continued to be recorded as late as 29 March at Upton Colliery Ponds. On 15 April a large clump of spawn that had completely hatched out (with a slick of tadpoles on top) was

observed at Havercroft Common Pond.

Few observations were made in respect to tadpoles and metamorphosis, although a metamorph was seen on 7 July at Wheldrake Wood. The last record for the Common Frog was of an immature recorded at Stanley Marsh on 18 August.

The species was widespread and abundant throughout the Wakefield District in 2002 and in the Doncaster District it was recorded at Hexthorpe Ings. It was also found at various sites across the Vale of York, being recorded from Selby Canal, Bishop Wood, Skipwith Common and a disused quarry at Womersley. JM reported it at several waters in the Dalby Forest area.

Common Toad *Bufo bufo*

43 records of the Common Toad were received for 2002, mainly from the Wakefield, Selby, North Yorkshire Moors and York areas. The first record was of a pair in amplexus seen by torchlight at Bretton Sculpture Park Circular Pond on 7 March, heralding the start of the breeding season. A further five adults and one immature were found under debris on 9 March at Upton Colliery. Numbers gradually built up during mid-March with 98 adults recorded by torchlight on 18 March at Lofthouse Colliery, rising to 297 adults (89 on land and 208 in the water) on 19 March. Spawn was first noted at Skipwith Common on 23 March, with spawning peaking around 24 March when 540 adults were counted by daylight at Pontefract Race Course Marsh Pond.

Tadpoles were first noted at Bullcarr Pond on 24 April, followed by Campsall Country Park Clay Pond on 4 May and Millington Dale Pond on 26 May. Many metamorphs were seen at Campsall Country Park Pond on 23 June and at Heath Half Moon near Wakefield, on 28 June. Individual or small numbers of immatures and adults were found under debris at a number of sites throughout the summer and autumn, the last record being a large adult found under a stone at Parson's Pond, Church Fenton.

Smooth Newt *Triturus vulgaris*

This species appears to be common and widespread throughout lowland Yorkshire, becoming somewhat rare on the uplands of the Pennines and North Yorkshire Moors.

The first record was of five adults seen by torchlight at Chevet Golf Course Ponds on 11 March. Numbers gradually increased in breeding waters throughout March, with two females seen ovipositing at Lupset Golf Course East Pond on 21 March. An adult male was found under debris on the edge of Cawood Castle Pond on 5 August, indicating that migration from breeding waters had commenced at that date; adults were subsequently found under debris at several locations, ten being found under paving stones at Parson's Pond, Church Fenton on 24 November. The last record was of a total of five found under debris at Skipwith Common (West) on 14 December.

The Smooth Newt was found at several sites throughout Wakefield District during 2002, including Chevet Golf Course Ponds, Lupset Golf Course East Pond, Sharlston Low Common Ponds, Heath Common Pond and Havercroft Common Pond, although never in large numbers (i.e. >100 adults). The numbers recorded at Lupset Golf Course Ponds were low, reflecting the catastrophic decline of the Great Crested Newt population at this site.

Fourteen adults were recorded by torchlight at Hexthorpe Ings by Doncaster WATCH Group on 16 March. In the Vale of York it was recorded from Skipwith Common, Church Fenton, Allerthorpe Common and Strensall Common. Although JM did not report this species from the North Yorkshire Moors area, he did record it from Burton Riggs near Scarborough.

Palmate Newt *Triturus helveticus*

Confusion with the Smooth Newt (Triturus vulgaris) probably results in under-recording of this species. The Palmate Newt does, however, appear to have strong affinities for particular areas. Very little information has been received regarding this species' habitats and ecology but it was first recorded on 23 March when six adults were seen by torchlight at Bishop Wood, Selby. No information on breeding, ovipositing or migration was received

for the year. The last record was of three adults caught in a bottle trap at Betty Crater, Cropton Forest on 2 June.

In the Wakefield District, where the Palmate Newt is relatively rare, it was recorded from Seckar Wood Pond, Seckar Wood Entrance Pond and Haw Park Pond. In the Vale of York it was recorded from Allerthorpe Common and Bishop Wood. JM found this species at many sites from the Dalby and Cropton Forest areas.

GREAT CRESTED NEWT *TRITURUS CRISTATUS*

36 records of the Great Crested Newt were received for 2002. Despite mild weather in January and February, the first records were of a single adult male seen by torchlight on 7 March at Lupset Golf Course East Pond and of four adult males seen by torchlight at Bretton Sculpture Park Circular Pond on the same date. Numbers gradually increased throughout March and April. Ovipositing females were recorded on 15 April at Chevet Golf Course Square Pond, indicating that mating and egg-laying were well under way at this time.

Migration from breeding waters appeared to have started during May, with two adults recorded under debris, well away from water, at Skipwith Common (West) on 26 May. Larvae were seen basking at the surface of Wheldrake Wood Pond on 29 July. The last record for the year was of a single adult found under debris at Skipwith Common (West) on 8 December.

During the year the species was found throughout its usual haunts in the Wakefield District, being recorded from Bretton Sculpture Park Circular Pond, Lupset Golf Course East Pond, Chevet Golf Course Ponds, Newhall Approach Pond, Sharlston Village Green Pond, Sharlston Common Pond and Havercroft Common Pond. It was also widely found throughout the Vale of York, being recorded from Askham Bog, Strensall Common, Wheldrake Wood Pond, Cawood Borrow Pit and Skipwith Common (West). In the Doncaster District it was recorded from Hexthorpe Ings, and a disused quarry at Womersley; it was also recorded from the North Yorkshire Moors at Yaul Sike Pond in Cropton Forest.

Of particular concern is the apparent dramatic decline in the number of Great Crested Newts recorded at Lupset Golf Course Ponds during 2002. RMS had surveyed these ponds on an almost weekly basis since 1997 with totals of 275 and 301 adults recorded in 1998 and 1999 respectively, but the considerably lower numbers recorded in 2000 and 2001 were attributed at the time to lack of recording effort (Table 2). The maximum count for the east pond was only 30 in 2002, with no adults being recorded in the west pond. Whether this decline has actually been over a period of years or was the result of a single catastrophic event is not known. It is also unknown whether the decline is part of a natural population cycle or due to human activity. It is noted that the pond has experienced considerable accumulation of leaf litter in recent years which may deoxygenate water. In addition, a goldfish has been spotted which may have preyed upon larvae. The above factors may have had an impact on the newt population at this site.

TABLE 2.
Maximum annual counts of Great Crested Newts at Lupset Golf Ponds (SE314189), 1995-2002.

Date	East Pond	West Pond	Total
1995	169	39	208
1996	102	3	105
1997	190	44	234
1998	249	26	275
1999	245	56	301
2000	107	3	110
2001	78	7	85
2002	30	0	30

ACKNOWLEDGEMENTS
The authors are indebted to all those people who contributed records, in particular Mr Tony Lane of East Yorkshire Bat Group for providing reptile records from Wheldrake Wood and Allerthorpe Common, Mr John Wollaston and all those owners who allowed access to their properties.

BOOK REVIEWS

Studying Invertebrates by **C. Philip Wheater** and **Penny A. Cook.** Pp. 120, with 111 figures & 4 coloured plates. Naturalists' Handbooks 28. Richmond Publishing, Slough. £15.00 hardback, £9.95 paperback.

This book tries to do many things in the study of invertebrates and by and large it is successful. The aim of the book is to give an overview of techniques and methods of analysis used in ecological sampling and investigations mainly of invertebrates. The main strength of the book is in describing methods of sampling invertebrates, the different kinds of numerical data that can be collected and how these data can be statistically analysed. The book starts with a chapter on designing an investigation followed by a longer chapter on different methods of sampling invertebrates in water, soil, leaf litter, sand, mud, on rocky shores, on and in plants, as well as flying insects. Then follows a relatively brief chapter on identification with many references to keys for marine, freshwater and terrestrial invertebrates. The keys suggested are mainly aimed at the inexperienced investigator. An appendix supports these earlier chapters with the addresses of suppliers of the necessary equipment and books. Next a chapter on describing data includes the use of tables, graphs and histograms, the different types of averages and variation (standard deviation, variance, interquartile range, standard error and confidence limits), estimating population size of stationary and mobile animals, dispersion and community diversity. Very full worked examples are given so that the necessary calculations can be easily followed. Then follows a chapter on statistical testing dealing with differences between samples (t-test, Mann-Whitney U-test, paired t-test, Wilcoxin matched pair test), relationships between samples (Pearson's, Spearman's and regression analysis) and tests of association between frequency distributions (chi-square test). Again very detailed worked examples are given. The necessary statistical tables for the tests are given in an appendix. In addition the authors have written a series of Microsoft Excel spreadsheet routines for calculating the statistics mentioned above for £10. Finally a brief chapter deals with the presentation of results introducing the reader to histograms, bar charts, box and whisker plots, scatterplots and pie charts besides how to create tables. I wish this book had been available when I was starting my studies. A must for anyone collecting numerical data and needing guidance.

MEA

Historical Atlas of Canada by **Derek Hayes.** Pp. 272, with 422 maps, mostly in colour. Douglas & McIntyre, Vancouver/University of Washington Press, Seattle. 2003. US$60.00, folio hardback.

An exploration of Canada's history through original maps, magnificently portrayed and ably described in this lavish volume. One thousand years are covered, from the Norse voyages onwards, illustrated with all the historically significant maps of the country since the famous Vinland Map (claimed to date from 1440).

Evidence, both hearsay and circumstantial, for the probably apocryphal pre-Columbian voyages is reviewed, but only after John Cabot's discovery of Newfoundland in 1497 can cartography be interpreted credibly, with Juan de la Cosa's world map (*c.*1500) showing

the presence of North America for the first time. The foundations for the French claim to Canada laid by their voyagers in the 1530s are cartographically interpreted, as are the early attempts by the English in the 1570s to find a northwest passage, with a bizarre polar map of 1583 "convincingly" showing a clear route.

The establishment of English and French colonies from the early 17th century onwards can be traced through place names, the major tracts entitled predictably New Scotland (Nova Scotia), New England and New France. More detailed cartography is provided for the development of towns (e.g. Montreal, Halifax), military actions (e.g. Fall of Quebec), coastal voyages (e.g. James Cook, George Vancouver, Martin Frobisher), inland journeys (e.g. Samuel Hearne, Alexander Mackenzie) and the operations of the influential Hudson's Bay Company. Consequent upon the American Revolutionary War, a new boundary to define Canada, based on the 1775 edition of John Mitchell's map, was ratified by the United States in 1783.

Westerly and northerly (arctic) exploration in the first half of the 19th century is detailed, much of this concerned with the search for the northwest passage epitomized by the expeditions of William Parry, John Franklin, Frederick Beechy, Richard Collinson, Robert McClure, Francis McClintock and James Ross; such maps are of particular interest to those like myself studying the plant collections (scattered mainly in British and North American herbaria, often underworked) of such explorers and the naturalists who accompanied them (e.g. John Richardson). Westward expansion is exemplified by the coming of the railways, the Canadian Pacific Railway, completed in 1885, truly linking the nation. The discovery of oil, the establishment of the nation's capital at Ottawa, the growth of cities, the Klondike gold-rush, and the eventual achievement of a northwest passage complete the picture.

A map catalogue, notes, bibliography and index complement this scholastic and copiously illustrated work by a geographer trained at the University of Hull. Those interested in Canada or maps in general will be bowled over by this lavish volume, for which we are indebted to both the author and publisher.

MRDS

Thorne & Hatfield Moors Papers, Volume 6, edited by **Martin Limbert.** Pp. vi + 96, with b/w illustrations. Thorne & Hatfield Moors Conservation Forum, Doncaster. 2003. £5.00 paperback (plus £1.20 postage & packing, from: Museum & Art Gallery, Chequer Road, Doncaster DN1 2AE.

This latest issue contains important papers on the environmental history of the bogs of the north-west lowlands, the conservation and origins of lowland raised mires, the buried forest of Thorne Moors, peatland archaeology and palaeoecology, and a revised checklist of the fungi of Thorne Moors. An editorial, a feature paper on a snapshot view of Thorne Moors, tributes to two honorary members (Geoff Gaunt & Peter Skidmore), 7 short papers and a literature review complete this interesting and well-produced volume.

MRDS

Fungi, Naturally Scottish by **Roy Watling** and **Stephen Ward**. Pp. viii + 33, full colour illustrations throughout. Scottish Natural Heritage Publication, Edinburgh. 2003. £4.95 paperback.

A delightful, well produced book with excellent photographs and clear text; however, perhaps a slightly larger black rather than grey type for the main text would be easier on the eye. The authors have covered a vast topic succinctly and clearly with a freshness which encourages one to move on to the next page. They have not overloaded the reader with scientific description, and, where such was required, they have provided straight to the nub explanation. The sections include definitions of and types of fungi; habitat and its importance to both the Fungi and Biodiversity and Conservation; how, when and where best to foray, what to look for, and what to leave behind. The penultimate section

emphasizes the role that Nature Reserves and Land Management can play in bringing the fungi more to the fore in people's understanding. The bibliography, list of societies, courses, pointers to field guides and electronic sources offer avenues for further exploration. A very good introduction to an unfortunately often misunderstood area of nature, at an acceptable price.

JW

Keys to the Case-bearing Caddis Larvae of Britain and Ireland by **I. D. Wallace, B. Wallace** and **G. N. Philipson.** Pp. 259. 2003. Scientific Publication No. 61. Freshwater Biological Association, Ambleside, Cumbria LA22 0LP. £22.00, paperback.

The first edition of this work, published by the same authors in 1990, very quickly established itself as an essential work for all those interested in freshwater ecology. The demand soon outstripped supply and thus the first edition has been out of print for many years.

The original 1990 edition contained 210 pages and 92 plates, whereas the new, enlarged and updated 2003 edition contains 264 pages and 107 plates. As well as the extra plates, many of the original 1990 plates have additional images to help with the identification of the more difficult species. The keys have also been revised, making this edition even better and easier to use. When referring to specific illustrations and plates, users will have to take care to indicate which edition they have used; for example, what was plate 80 in the 1990 edition is now plate 88 in the new edition.

A great deal of work has been undertaken on the identification and distribution of caddis-flies since the publication of the 1990 key and we now have a better understanding of the distribution of many species. This additional distribution and environmental information has also been included in the new edition.

The new publication uses a clearer typeface and the tabulated sections have been newly laid out, making them much easier to read and understand. New editions are often a great disappointment, taking little regard of the feedback from users. In contrast, this FBA publication sets the standard for any future reprinting of important keys.

AN

Tarns of the Central Lake District by **E. Haworth, G de Boer, I. Evans, H. Osmaston, W. Pennington, A. Smith, P. Storey** and **B. Ware.** Pp. x + 204, with 29 colour plates, 34 b/w illustrations & 50 bathymetric maps. 2003. Brathay Exploration Group Trust, Ambleside. £12.00 paperback.

More numerous, but less well studied than the celebrated lakes of the English Lake District, are its tarns. These are intermediate in size between ponds and lakes. Many of them are scenically attractive, some dramatically so, and some are of great interest to geomorphologists and naturalists alike. All the 50 examples included in this delightful publication owe their origin in one way or another to the work of ice. Most remarkable is Blea Water, a rock basin in a cirque excavated by a local compact, cirque glacier. Its excavation was complex and involved rotational flow of the ice, some aspects of which are still puzzling. Others were scooped out as a result of selective erosion by the ice sheet that once covered the area, others were dammed by moraines, and some were the result of a combination of factors.

There are short chapters on geology, glaciation and late glacial and post-glacial changes in the tarns, based largely on the sequence of diatoms preserved in their bottom deposits. These deposits, and particularly the pollen grains preserved therein, also throw light on the post-glacial history of the vegetation, soils, climate and human settlement of the area.

For over half a century young people, guided by the Brathay Exploration Group, have systematically surveyed Lakeland tarns and produced maps that accurately portray their depth contours. Fifty such maps are published here, accompanied by enlightening texts that

report the salient features of each tarn studied. Supported by attractive and informative photographs and sometimes by relevant diagrams, or portraits of diatoms, these provide an excellent compendium of previously inaccessible information.

Only one thing mars the work. The accounts of individual tarns include notes on the floras (extant and extinct) and faunas. Of necessity these are uneven and incomplete. More seriously they are often inaccurate. Animals in particular are often denominated by obsolete or mis-spelled names, are wrongly classified, or are even given a meaningless name. For example, reference to "the flatworm *Platyhelminthes"* confuses the nature, name and classification of the animal concerned. *Cedodaphnia excisa* seems to be a combination of a mis-spelling of *Ceriodaphnia* (an anomopod branchiopod) and the specific name of another anomopod of a different family, *Alonella excisa*; there are no such animals as *Alonella elongata* or *Daphnia gracilis* (was the copepod *Eudiaptomus gracilis* intended?); Corixidae is a family, not a generic, name and so on. There is a four page list of species mentioned in the text, but no localities are given, and a casual check revealed more than 40 omissions. Moreover 80 species of desmids were recorded from one tarn and well over 100 from another, and almost 50 lichens were collected from each of two other tarns, but names are not provided. It is a pity that, even though many readers will perhaps be unaware of them, such errors and omissions mar a work tht succeeds admirably in its main objective. Let us hope they will not deter would-be buyers of this otherwise excellent and well produced volume.

GF

The Vanishing Tiger by **Vivek R. Sinha.** Pp. 256, incl. many colour plates. 2003. Salamander Books. £20.00 hardback.

The author is an internationally acknowledged wildlife photographer and this book is doubtless a vehicle for the excellent photographs of his favourite subject, taken in his native India. It is, however, much more than that: the first section (60 pp.) has a colour photograph on every page, some as a double-spread, which are accompanied by very readable text dealing with the history, folklore and myths, habitat, hunting techniques, territory and the family life of this enigmatic beast.

Two further major sections (128 pp.) dealing with the tiger's co-predators and prey species make fascinating reading and every animal is beautifully illustrated. Other chapters on tiger reserves, photographing tigers and sub-species and their distribution, together with a detailed bibliography, combine to make an excellent and lavish book which is well worth the price if only for the photographs, but especially if one has an interest in this colourful country and, more particularly, this endangered species.

JRM

A Guide to Keeping Common Frog Tadpoles by **Rona Oxford**, with illustrations by **Anna Sutton**. 2003. Field Studies Council, Preston Mountford, Shrewsbury, Shropshire SY4 1HW. £2.50 plus £1.00 postage & packing.

This is a well designed, clearly written, helpfully illustrated, fold-out laminated sheet on the common frog that gives useful guidance to teachers and individuals who wish to rear this once familiar animal. There are also hints on its conservation. While an excellent product, the cost seems rather high, especially for something that deserves to be widely disseminated.

IRISH NATURALISTS' JOURNAL

The *Irish Naturalists' Journal,* sucessor to the *Irish Naturalist,* commenced publication in 1925. The quarterly issues publish papers on all aspects of Irish natural history, including botany, ecology, geography, geology and zoology. The *Journal* also publishes distribution records, principally for cetaceans, fish, insects and plants, together with short notes and book reviews.

Current subscription rates for four issues (including postage): €25.00 (£15.00 stg); Students €8.00 (£5.00 stg). Further details from: Mr Brian Nelson, INJ, Department of Zoology, Ulster Meseum, Botanic Gardens, Belfast BT9 5AB.

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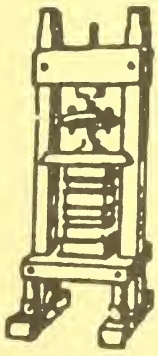

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April-June 2004

Number 1049
Volume 129

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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***Daphnia* Shoals: their behaviour and co-ordination. A problem for the field naturalist** – *Geoffrey Fryer*

The lichen flora of Hull, with particular reference to zonal distribution and environmental monitoring – *M. R. D. Seaward*

The Beetles of Spurn Peninsula: a second update – *M. L. Denton*

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Records of Mole-crickets *Gryllotalpa* (Orthoptera: Gryllotalpidae) in Yorkshire – *Martin Limbert*

SMITHSONIAN
AUG 2 0 2004

Published by the Yorkshire Naturalists' Union

Editor **M. R. D. Seaward** MSc, PhD, DSc, FLS, The University, Bradford BD7 1DP

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Manuscripts (two copies if possible), typed double-spaced on one side of the paper only with margins at top and left-hand at least 2.5cm wide, should be submitted. Latin names of genera and species, but nothing else, should be underlined. S.I. Units should be used wherever possible. Authors must ensure that their references are accurately cited, and that the titles of the journals are correctly abbreviated. Volumes of *The Naturalist* for the years 1886 to 1975 have been retrospectively numbered 11 to 100 to accord with numbering before and after this period (see YNU *Bulletin* no. 3, pp. 21-22 1985); please cite these volume numbers in all references. Table and text-figures should be prepared on separate sheets of paper. Drawings and graphs, drawn about twice the linear size they are to appear, should be in jet-black Indian ink, and legends should not be written on the figures. **Publishable manuscripts not conforming to the above requirements will be returned for alteration.**

Photographic Plates

Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record his deep appreciation of this imaginative gesture.

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Institutions and Subscribers £24.00 Registered Charity No. 224018

DAPHNIA SHOALS : THEIR BEHAVIOUR AND CO-ORDINATION. A PROBLEM FOR THE FIELD NATURALIST

GEOFFREY FRYER
Institute of Biological and Natural Sciences, University of Lancaster, Lancaster LA1 4YQ

Introduction

Some of the most spectacular phenomena displayed by animals are the aggregation of certain birds and fishes into enormous flocks and schools that act as single, marvellously co-ordinated units. Such assemblages often undertake complicated manoeuvres that clearly depend on an awareness by each component member of what its companions are doing, and an ability, not only to detect their movements but to respond to them with extreme rapidity and to co-ordinate its own movements with theirs with great precision. Wheeling flocks of Starlings, *Sturnus vulgaris,* and waders provide familiar avian examples. Among fishes, schools of Minnows, *Phoxinus phoxinus,* are easily observed in shallow water though here they are sometimes little more than two-dimensional. Thanks to developments in underwater cine photography, the co-ordinated behaviour of open water schools of clupeid and other fishes has been revealed to viewers of television programmes who are privileged to see, in wonderful detail, activities that were but little known until recently.

Some invertebrates form what are in some respects aggregations that display similar behaviour. All-male swarms of chironomid midges (Diptera) that assemble for the purpose of mating are perhaps the most familiar, and those of rapidly moving empid flies of the genus *Hilara* are even more impressive. Aggregations of whirligig beetles (Gyrinidae) provide a two-dimensional, and therefore simpler demonstration of an outstanding feature of such actively moving assemblages, which throws into relief the even greater complexity of true shoals. The convoluted gyrations of gyrinids on the surface of a pond – which may be social displays – are carried out at great speed without colliding with each other. However, while individuals navigate with great precision, these are virtuoso solo displays and not orchestrated performances of the entire ensemble. The aggregation does not behave as a unit that moves purposefully around, nor do its members have to interact in three dimensions.

It appears not to be well known that more complex, co-ordinated, three dimensional performances are enacted by some small aquatic invertebrates. Some pond-dwelling species of the branchiopod crustacean *Daphnia* (Figs. 2 & 3) and related genera, commonly referred to as water fleas, indeed display behaviour akin to that of flocks of birds and schools of fishes, and sometimes move around in enormous shoals. The similarities of such shoals to vertebrate assemblages, and their differences, are intriguing.

Consideration of the shoaling behaviour of *Daphnia* and its relatives is complicated by the fact that these animals form different types of aggregations. What are here called swarms may include many thousands of individuals gathered into a conspicuous mass, generally with diffuse boundaries. These are the commoner of the two sorts recognised here. When the need for continuously moving individuals within the swarm to avoid collisions is considered, these are remarkable assemblages. They are, however, outdone as spectacles by shoals in which vast numbers sometimes move around as a co-ordinated whole, like a super-organism. It is with the latter that we are largely concerned here. However, distinct as these categories sometimes are, some aggregations are less easily defined, and any classification is of necessity arbitrary. Swarming is also distinct from the well known 'patchiness' of the plankton, though the two phenomena to some extent grade into each other. In both freshwater and the sea planktonic animals are not evenly distributed throughout the open waters but, for a variety of reasons, a particular species may occur in patches where its abundance is greater than elsewhere. To give one example Dumont (1967) studied the patchiness of *Bosmina longispina* (then called *B. coregoni*), a smaller

relative of *Daphnia* and of a different family, for five consecutive days in August in a well defined area of a very shallow Belgian lake where it was abundant. One litre samples were taken from 40 regularly spaced sites each day within a period of no more than 30 minutes. The size, density (minimum 30 per litre.: maximum *c.* 10,500), and location of the patches changed from day to day, following no coherent pattern, and it was impossible to discriminate between deliberate movements and passive transport, but Dumont believed that a controlled component must be involved. The, animals were not, however,, shoaling, or even swarming. In a German lake, Künne (1925) recorded more definite aggregations of *B. longirostris* into bands 20 to 60 cm long and several centimetres wide, but attributed their formation to water movements. On the other hand, I have encountered small aggregations of *B. longispina* (less dense than swarms and shoals of *Daphnia*) in the littoral region of Windermere that appeared to be associated with clumps of vegetation and assumed that these were the result of purposeful movements, but these were very different from co-ordinated shoals of *Daphnia*.

Early reports of shoals of *Daphnia*

Although aggregations of *Daphnia* were noticed long ago, surprisingly little attention has been paid to the phenomenon, and indeed references to true shoaling are few. It is particularly ironic that Jan Swammerdam (1669), who was the first to give a description that indisputably refers to *Daphnia*, and to provide a recognisable illustration, also refers to having seen these animals, which he refers to as "getakte watervlooy" (branched waterfleas) in a horse pond in such numbers as to give it the colour of blood, and says that a friend, a fellow Dutchman, had seen the same in a canal. It is not clear whether they saw a swarm or a shoal. Nevertheless, it was evidently as a result of their aggregation – visible to the naked eye – that Swammerdam's attention was drawn to these animals. His observations on *Daphnia* were, however, but a minor element in his contribution to biological knowledge. He is more celebrated for his superb dissections of such insects as mayfly larvae, bees, and butterflies, for his work on the anatomy of the human womb, and his skilled injection of warm coloured wax into blood vessels to facilitate their study in anatomical preparations.

Apart from Swammerdam's equivocal report, the first reference to what seems to have been true shoaling behaviour in *Daphnia* that I have traced is that of Abraham Trembley (1744) which, probably because of the context in which it was described, seems to have escaped attention. His observations are recorded in his remarkable monograph on *Hydra,* one of the early classics of biology, and his interest in *Daphnia* was largely utilitarian – he collected these animals as a source of food for *Hydra*. This did not, however, prevent him from making significant discoveries. Trembley did not use the name *Daphnia* – not then coined – but referred to these animals as what translates into English as "water fleas with branched horns" the horns being the branched antennae. He provided a small illustration which leaves no doubt as to their generic identity, but it is not certain which species was involved: it may well have been *D. pulex*. He noted that they could be seen in great abundance on warm calm days, and that "At such times, large areas of ditches that are full of them are tinted with a reddish colour", which is because (as noted below) especially in poorly oxygenated water, the blood of pond-frequenting species contains appreciable amounts of haemoglobin. He says succinctly and very precisely that "I have seen these bands about a foot wide and more than fifty feet in length; there the water fleas were so dense that absolutely nothing else was visible. They seemed to concentrate particularly in areas where the sun shone. Perhaps the sunlight attracts them". Although he says nothing about the movement of these bands, his description is in keeping with the gathering of *Daphnia* into true shoals.

In making the suggestion that sunlight may attract them, Trembley may have been doing more than stating what seemed obvious. He had noticed that candlelight attracted them, and described how he had done simple experiments in glass jars in which he discovered that, after dark, his water fleas followed a lighted candle as it was slowly moved around the jar. These are probably the earliest experiments carried out on *Daphnia*. Reactions to light are,

however, much more complicated than was then realised, and differ, for example according to whether a point source or diffused light is involved. This is nicely, and very simply shown by comparing with that of Trembley my own earliest experience of the reaction of *Daphnia* to light. Some sixty years ago, when I knew little about these animals, I temporarily placed a glass jar containing numerous individuals of what was probably *D. pulex* or *D. obtusa,* in a dark cupboard. On opening the door all the animals that had, in darkness, congregated in the upper part of the jar, dived *en masse* to the bottom. Closing the door caused them quickly to ascend to the upper region, a reversal of migration that was repeated every time light was admitted or excluded. Although I then knew nothing of such things, this is essentially the reaction of planktonic species that migrate to the upper layers of lakes and large ponds by night and descend by day, using light intensity as a cue.

Simple but dramatic reactions to light are also easily seen if individuals of pond-frequenting species of *Daphnia* or its smaller relative *Ceriodaphnia* confined in a glass jar are placed in strong sunlight near a window. These immediately swim to that side of the jar most remote from the light source, and there form a dense crowd. If the light is then screened off by a sheet of card, they begin to disperse and soon become more or less evenly distributed in the horizontal plane. (They may tend to congregate towards the bottom of the vessel.) Removing the card causes them again to swim away from the light source. Such reactions are repeated every time the sun is allowed to shine on the jar or is screened from it. To the complexities of *Daphnia*'s reactions to light we will return.

Although Baird (1850) mentioned that Trembley noticed *Daphnia*, he was evidently unaware that he described shoaling. Thus, according to Baird, the red patches produced by the aggregations of *Daphnia* reported by Swammerdam about 180 years earlier were never subsequently reported until he recorded his own observations. Baird tells us that he had frequently seen huge patches of water in ponds "assume a ruddy hue, like the red of iron, or as if blood had been mixed with it and ascertained the cause to be an immense number of *D. pulex*". Aggregations of *Daphnia* are indeed one of the explanations of 'water turned into blood' which from time to time alarm the superstitious. Baird noted that "The myriads necessary to produce this effect is really astonishing", and went on to provide a graphic description of the nature of the shoals and their motions. "On sunshiny days in a large pond, a streak of red, a foot broad and ten or twelve yards in length, will suddenly appear in a particular spot, and this belt may be seen rapidly changing its position, and in a very short time wheel completely around the pond. Should the mass come near enough the edge to allow the shadow of the observer to fall upon them, or should a dark cloud suddenly obscure the sun, the whole body immediately disappear, rising to the surface again as soon as the cloud has passed over". This appears to be the first precise description of a shoal and its movements. The dimensions of the shoals are similar to those described by Trembley. When Baird made these observations the name *D. pulex* embraced more than one species, but the probability is that the animals concerned were indeed that species.

Birge (1897) reported probable shoals of the planktonic *D. hyalina* in Lake Mendota, USA. These, seen when conditions were very calm, took the form of patches, measurable in tens of metres, in the upper few centimetres of water. Such aggregations seem to be more common in smaller water bodies.

More recent observations

Considering the dramatic nature of shoaling, reports in more recent literature are surprisingly few. Their paucity may reflect a lack of awareness of the phenomenon, which was frequently seen by Baird, who became familiar with it, or a simple disregard by students of these animals of their behaviour in nature. Even swarming, which, while impressive, is less dramatic, seems to have been under reported until recently. Berg (1931) encountered shoals of *D. pulex* and *D. magna*, but on only a few occasions, during an extensive survey of the reproduction of the Danish species of the genus. He described shoals of *D. pulex* as reddish-yellow patches about one metre long and half as broad, made up of thousands of individuals. Occasionally seen shoals of *D. magna* "were visible at a

distance of many metres from the pond.as reddish yellow patches of varying shape measuring up to 1m in diameter", but only 2 to 10 cm deep.

Johnson and Chua (1972) observed shoals of a probably undescribed species of *Moina* in a small, very shallow pond in Malaya. *Moina* is a primitive member of the Daphniidae on which some would bestow family status. Although these shoals were much smaller than is generally the case in *Daphnia*, they displayed all the key attributes of such assemblages. They were only about 10 cm long and 5cm wide. Johnson and Chua vividly describe their behaviour. They moved "as co-ordinated wholes, slowly forwards in the direction of the long axis. Occasionally in mid-pond and always when the borders of the pond were approached the direction was changed. When this happened the patch maintained its definite form and the whole patch bent and turned". The animals were densely packed and Johnson and Chua emphasised that they made up "schools and not ordinary aggregations. All the individuals appeared to orientate in the same direction and the borders of the schools were well defined". The reference to "ordinary aggregations" is very pertinent. As these observers point out, some degree of clumping or aggregation is well known among small planktonic crustaceans, but such aggregations are less densely packed, have less well defined boundaries, and the participants do not maintain ordered swimming as a group, nor does the aggregation show 'super-organism' characteristics in its behaviour. Johnson, who died young, was well acquainted with daphniids both in the field and under the microscope, and his remarks carry the weight of experience. That he was clearly familiar with swarms of *Daphnia*, but not with shoals, reflects the paucity of information on, and almost certainly the less frequent displays of, the latter. Two further points from this account are noteworthy. Individuals detached from shoals rapidly rejoined them; shoals disintegrated when collected and did not re-assemble when kept for study.

As is already apparent, shoals may be of very different shapes – elongate or more compact – and size, and shoals of different shapes may be present at the same time. In July 1972, in the moat of the former ecclesiastical palace at Howden, Yorkshire, that had recently been cleared and deepened in places, *D. pulex* was present in millions, many being aggregated into shoals that were intensely red and very conspicuous. Some were long straggling bands, others, of which there were many, just below the surface, were circular in plan and were slowly revolving in a clockwise direction. These were not measured but probably did not exceed about 30 cm in diameter. Some revolving groups had a 'nucleus' of a few floating plants of *Lemna* at the centre. Nowhere else have I encountered such. A photograph of a *Lemna*-centred shoal reveals that while the *Daphnia* formed a dense mass, this was to some degree continuous with less dense ribbons of more diffuse aggregations (swarms rather than shoals!) containing denser assemblages, the whole being reminiscent of a reticulate shoal of *Moina brachiata* described below.

An interesting feature of these shoals is that they were not easily disturbed whereas, as Baird noted, the casting of a shadow causes shoals moving around a pond to sink. Indeed in this very moat the late John Dealtry parted some aggregations which quickly reunited. Such seemingly, but probably not, inconsistent behaviour is at present inexplicable.

A different pattern of what seemed to qualify as shoaling was displayed by *Moina brachiata* in a pond frequented by domestic ducks at Burneside Hall, near Kendal, Cumbria. Here, in the evening of a very hot day in July 1983, vast numbers were swimming near the margin and just beneath the surface, most of them probably in the upper 1 or 2 cm. of water. These took the form, not of straight columns but of reticulate bands extending for many metres, of which Figure 1, not an exact representation, gives a general impression. A small jar dipped into the bands seemed not to disturb the animals and caught hundreds, yet could be dipped into spaces between them without catching more than a few stray individuals. The shoal consisted predominantly of parthenogenetic females but included a few males and ephippial females. *M. brachiata* is rare in Britain and this was the first time it had been seen in Cumbria. In August 1984 a visit yielded a single individual. Some years later no *Moina* were found but a small form of *D. obtusa,* not shoaling, was present. Curiously this common species is virtually absent from the Lake District, of which

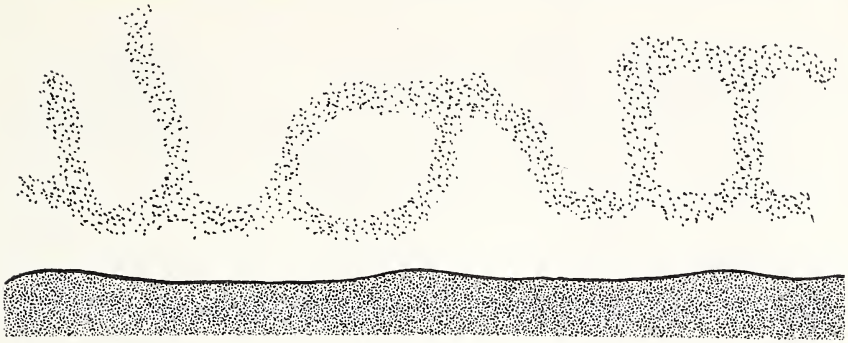


FIGURE 1.
Part of a shoal of *Moina brachiata*, July 1983. Based on a sketch made while the pattern was fresh in the mind, this serves only as a general indicator of the nature of the shoal, and does not purport to be an exact representation. No scale can be given, but the "rope" of animals was perhaps *c*. 10-15cm wide.

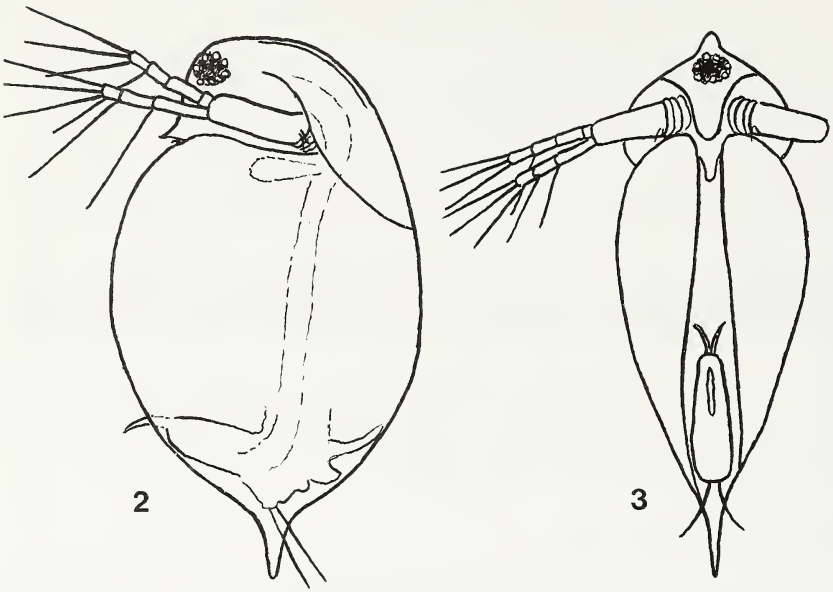
Burneside is at the fringe.

A record from a lake, described as a swarm, is that of Colebrook (1960) who saw an aggregation of what is now recognised as *D. galeata* in a deep, sheltered bay of Windermere in June 1955. This was about a metre in diameter, confined to the upper 10 cm of water, and the animals present exceeded 9000 per litre.

Attributes of *Daphnia* and its relatives that may be relevant to shoaling

Daphnia is a genus of the order Anomopoda with about ten British species. All have the general form shown in Figures 2 and 3. Few exceed *c*. 3 mm in length, though *D. magna* achieves 6mm but is usually smaller. Some species frequent small water bodies, or sheltered backwaters of large; others occur in lakes where some are planktonic. It is mostly among the former that shoaling has been observed. Other than sometimes participating in such gatherings, all species are asocial animals. All are free-swimming and all feed on suspended particulate matter collected by drawing water through large filters borne on the third and fourth pairs of trunk limbs, though some, such as *D. magna*, also forage on the bottom where stirred up particles are ingested, and *D. obtusa* can sweep material from surfaces.

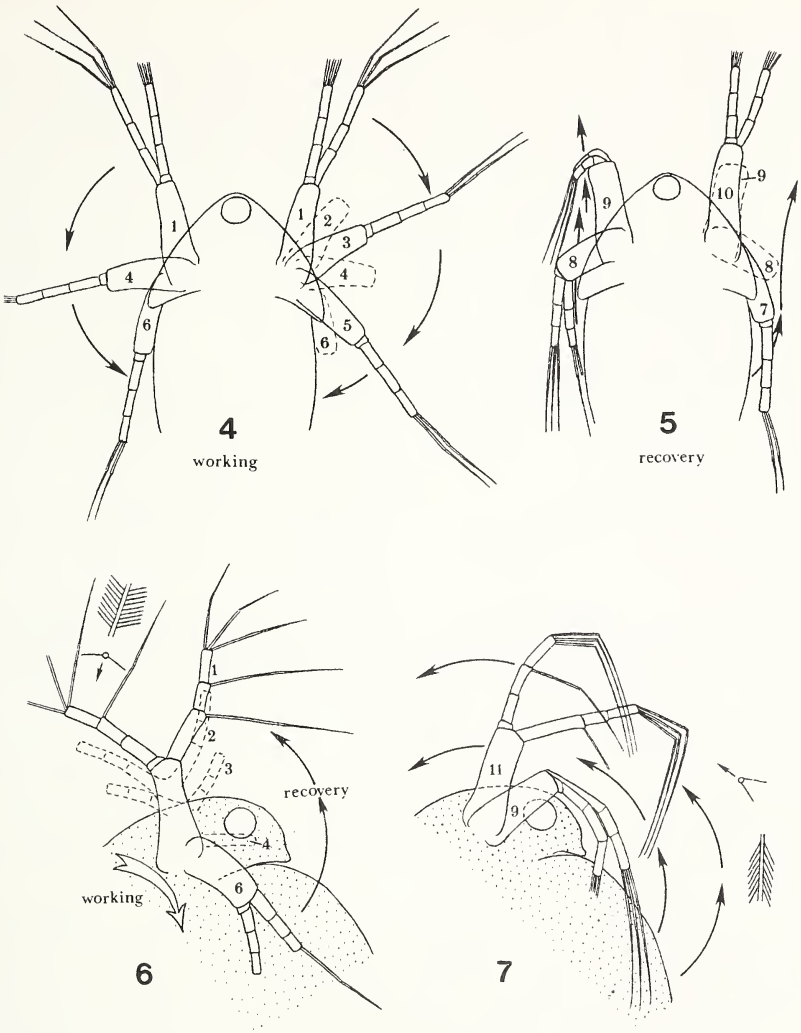
Daphnia swims by rowing with the large biramous antennae whose oar-like movements are shown in Figures 4-7. A basal 'universal joint' and complex musculature endow these appendages with extreme mobility. As they swing on the working stroke, essentially ventrally, posteriorly, and therefore for part of the cycle inevitably outwards, they are fully extended to present the maximum surface area, and the rows of fine setules (natatory setules) with which the long setae are provided are also spread for the same purpose (Figs. 4 & 6). On the return stroke they and the long setae, which are hinged, are flexed to reduce drag and the natatory setules trail limply so as to do likewise (Figs. 5 & 7). Much time is spent moving up and down in the water, the long axis of the body being more or less vertical or inclined somewhat forwards. A short burst of activity by the antennae, beating at up to about 250 cycles per minute, propels the animal upwards; the antennae then cease to beat and are extended widely, and it begins to sink slowly, the extended antennae acting as parachutes. This sequence of hop and sink is continuously repeated with small displacements from the vertical so that different columns of water are exploited for food during each cycle. Powering such a cycle far from exhausts the repertoire of the antennae.



FIGURES 2 and 3.
Outline sketches of *Daphnia pulex* (length *c.* 2 mm.) lateral and ventral, swimming. The antennae are being swung on the working stroke and have proceeded furthest in Figure 3, so their long natatory setae appear foreshortened. The postabdomen has also been swung forward in this figure. The complex ventral trunk limbs enclosed within the carapace chamber are not indicated.

Very rapid beating (10 or 11 cycles per second) can be achieved, the angle of attack can be varied, the amplitude of beat can be curtailed, the rami of the antennae can be flexed at their joints and the angle between them varied, and one appendage can beat faster than the other. This grants great versatility to the apparently simple act of swimming so that, when necessary, it is possible to swim rapidly, change direction, dive steeply, and perform other manoeuvres. Details of movements and of the complex musculature involved are given by Fryer (1991). The perfection of muscular action and its nervous control is beautifully demonstrated when dense congregations of individuals are confined in a vessel where they swim rapidly on interweaving courses without collisions, and when vast numbers move around in a shoal.

As movements are controlled by the nervous system, a word on sensory receptors and nervous equipment is in order. The most obvious receptor is the large median compound eye – derived from paired eyes, which still appear in the embryo. It has 22 ommatidia, each with a clearly separated lens, and can be rolled to a limited degree by a series of muscles. It has been suggested that regular rolling – 'trembling' – enables it to scan for visual information and it seems able at least to locate things like a point source of light or a light / dark boundary, but if Young and Downing (1976) are correct and the focal length of the lenses greatly exceeds the length of their rhabdoms, image formation is impossible. The eye is reputedly involved in orientation, some four pairs of ommatidia and their lenses being involved in the process, but eyeless individuals appear to manage their affairs reasonably well! What has been learned about the abilities of the eye seems to fall far short of explaining how it could even inform an individual of what adjacent members of a shoal



FIGURES 4-7.

Antennal movements in a swimming *Daphnia*; successive positions, based on a ciné film, are 0.01 sec. apart. 4 and 5: *D obtusa*, seen from dorsal side; except in positions 1 and 8-10, only one ramus of the appendage is shown. 6 and 7: *D. magna*, seen laterally; the full complement of natatory setae is shown only at positions 1 and 11; from position 1 the antenna rises towards the observer until it lies perpendicular to the plane of the paper, then descends into the plane of the paper as it continues its backward swing. Insets (semi-diagrammatic) show how the setules of the natatory setae are spread to give thrust during the working stroke, and flexed (trail) to reduce drag on the recovery stroke. (From Fryer 1991, with permission).

are doing, let alone pass information to the central nervous system that is sufficiently precise to allow it to react by co-ordinating its actions with theirs. Adjacent to the eye is a much simpler ocellus.

The antennules (first antennae) are very small – a mere mound bearing a tuft of supposedly olfactory sensilla and a minute, presumably tactile, seta. These appendages, reduced in size in relation to open water swimming, habits, are clearly derived from longer appendages in bottom-frequenting ancestors that, like those of modern benthic species, explored the substratum and the region ahead of the animal. At the base of each antennna is a pair of short sensory setae. Their original function was undoubtedly tactile, and clearly still is in both primitive, and highly specialised, bottom-frequenting anomopods in which they fulfil a role analagous to a cat's whiskers. Their position and the habits of *Daphnia* suggest that there is little scope for this here and they conceivably serve as detectors of motion, and are perhaps even able to detect the presence of adjacent individuals, but this is pure speculation.

In the head there is what is variously called a lateral frontal or parietal sense organ. This consists of several small clusters of cells located just below the cuticle in the antero-dorsal region, each supplied by a fine nerve from a slender common nerve that arises from the cerebral ganglion. Its function is uncertain. While it has been suggested by some that it serves for light perception, it may be a pressure gauge. A somewhat similar single organelle, the median or ventral frontal organ is similarly innervated.

The post-abdomen bears a pair of long, posteriorly-directed sensory setae that primitively served in benthic forms as an early warning system of danger from behind. There is little scope for this in *Daphnia*, but if animals in a shoal swim quickly with the body for a time more or less horizontal it may possibly serve in some way in communication.

The subtlety of antennary movements in relation to the need to move in a particular manner at a given instant clearly reveals the continuous reception of detailed information by the central nervous system and is strikingly demonstrated when the animals are moving in shoals. Yet this is no bird or fish but an animal that belongs to what is generally recognised as the most primitive sub-class of the Crustacea.

Pond-dwelling species of *Daphnia* have the ability to synthesise, and lose, haemoglobin. As they often frequent situations where low oxygen concentrations are encountered, this enables them more efficiently to acquire oxygen, to their advantage. The haemoglobin renders them red in colour, which makes shoals conspicuous. Planktonic species that live in well-oxygenated water have no need of haemoglobin. It would indeed be disadvantageous by making them conspicuous to plankton-eating fishes. Their adaptations are towards transparency. Pond-dwelling species often live in fish-free habitats.

As males have, I believe incorrectly, been implicated in attempted explanations of the purpose of shoaling behaviour, a word on reproduction is necessary. *Daphnia* is predominantly parthenogenetic, and during the summer months in temperate latitudes populations usually consist entirely of females. These shed successive clutches of eggs into the brood pouch beneath the carapace and there brood them until they hatch, and continue to do so until they are released as miniature replicas of their mother. Some planktonic species have become obligate parthenogens. Males usually appear as conditions deteriorate in autumn, but may do so at other times, again usually when adverse conditions prevail. They are smaller than females and are provided with claspers for gripping their mate. The antennules are modified to form one pair, which still bear sensilla, and the first trunk limbs bear a more robust pair. The post abdomen is modified for the purpose of conveying sperm to the female.

Mated females produce resting eggs – just two in each clutch in *Daphnia* but from one to several in other anomopod genera. Resting eggs, enclosed between and protected by, modifications of the carapace are shed as a capsule called an ephippium when the female moults. These eggs can withstand freezing and complete desiccation, like a plant seed, and remain viable for many years, but many probably hatch when favourable conditions return

in the following year and give rise to a new generation of parthenogenetic females.

A final fact relevant to shoaling is size related. Because *Daphnia* is much smaller than even small fishes it effectively inhabits a more viscous medium – technically a low Reynolds number environment. To make an extreme comparison, a large, moving oil tanker long continues under its own momentum if the engines stop; if *Daphnia* switches off its engine (the antennae) it stops almost at once. The antennae are smaller than the animal itself and operate at an even lower Reynolds number. Even small shoaling fishes live in a less viscous, higher Reynolds number environment, than does *Daphnia*.

Some supposed advantages of flocking, schooling and shoaling

Co-ordinated movements of large, well integrated flocks and shoals, whether of birds, fishes, or *Daphnia* must be advantageous or they would not have evolved. However, not all suggested advantages are universally convincing. Protection against predators by having many alert individuals on watch so that evasive action can be taken by the flock may hold good in birds, but can hardly apply to *Daphnia*. Likewise, although supported by experiments, the confusion effect, whereby a predator confronted by many potential food items cannot 'make up its mind' which to take is not entirely unambiguous. Pike, *Esox lucius,* and Perch, *Perca fluviatilis,* confronted by 20 small cyprinids eat fewer than when confronted by six, and Pike offered Minnows, one at a time, easily catch six or seven at the first attempt before satiation, but if confronted by a school may take two to three hours and eight or nine attempts before catching a single one. *Daphnia* itself benefits when offered to Goldfishes, *Cyprinus carpio*, in groups of 600 or so, when fewer are eaten in an hour than if offered in batches of 100. Safety in numbers therefore sometimes holds good. Much, however, depends on the predator and on circumstances. If a school of Herrings, *Clupea harengus,* is attacked by predators, it contracts into a spinning mass or ball of closely packed individuals. This may protect it against some predators, but some that hunt in packs may break up the ball and destroy the entire school. Schooling is also no protection against certain whales. Likewise hungry Sticklebacks, *Gasterosteus aculeatus,* preferentially attacked the dense centre of a simulated swarm of *Daphnia*, but as hunger was abated increasingly preferred less concentrated, more peripheral individuals.

The advantages of shoaling in *Daphnia* are obscure. Protection by the confusion effect may occur at times, though shoaling appears to be relatively infrequent and can hardly be for protection, and both swarms and shoals certainly sometimes occur in fish-free situations. Shoals are often so compact that predation may be facilitated. Shoals tend to frequent what are probably the warmest, best oxygenated regions of the environment, but shoaling is not a prerequisite for this, and it is difficult to imagine any advantage in collecting food that accrues from the habit.

How shoals of *Daphnia* ignore the rules of how to behave

How *Daphnia* reacts to light, and the role of light in controlling or stimulating important aspects of behaviour have prompted many investigations. An ironical aspect of many of these is that they involved experiments that sought to explain how vertical migration (ascent to the upper layers of water by night, descent to deeper water by day) is controlled, but used *D. magna* as the experimental animal. Its large size and the ease with which it can be cultured have proved attractive and have blinded some experimenters to the fact that it is *not* a planktonic species and is far from being a good exponent of the phenomenon of vertical migration. Different species of *Daphnia* differ greatly in habits and ecology. Experimentalists are not always naturalists, which can have unfortunate consequences. *D. magna* is essentially a frequenter of small, often shallow, organically enriched ponds and sometimes of sheltered bays of larger water bodies. In shallow ponds there is little scope for vertical migration: where the water is a metre or more deep it may show some movement towards the surface at dusk. Some experimentalists have not only asked questions of *D. magna* that it is ill equipped to answer, but have even failed to observe that it generally swims with the long axis of its body vertical, and one at least assumed that it

was normally horizontal! Nor is it always certain to which species published observations apply. In one detailed paper on *D. magna* the only illustration of the animal included is a photograph that is certainly not this species.

A brief history of early studies on light-induced swimming in *Daphnia* was given by Ringleberg (1964) who has done much work on the matter, using especially *D. magna*, and who provided an informative summary (Ringleberg 1987). Ringelberg was aware that this species is not planktonic, but it served well as an experimental animal for his investigations. A succinct summary of its reactions to light is that decreases in the intensity of illumination lead to positive phototactic responses (i.e. movement towards the light source); increases to negative responses (movement away from it). More precisely, in relation to shoaling, which he did not consider, two findings are particularly important. Both instantaneous and continuous changes in light intensity evoke virtually the same phototactic reactions. "With illumination from above, decreasing light intensities result in positive phototactic upward swimming; increasing light intensities result in negatively phototactic downward swimming". He also emphasised that an instantaneous increase in illumination, if of sufficient strength, "induces either a short period of passive sinking or an active downward movement" (Ringelberg 1987). These are well-founded statements on how *Daphnia* normally reacts to changes in light intensity. Complications such as mutants that behave differently are ignored here. To complicate matters further the planktonic *Holopedium gibberum*, a member of the more primitive order Ctenopoda, sometimes shows reverse migration – towards the surface by day, to deeper water by night!

Here it is necessary only to accept the reality of these reactions, but a surprising, indeed bewildering, fact demands mention. It might reasonably be assumed that it is the compound eye that records changes in light intensity. In fact neither it nor the ocellus does so, or at least they are not necessary for this purpose. Animals from which the compound eye has been removed, (a simple but barbaric procedure) and whose ocellus has been destroyed, remain sensitive to such changes and react to them. Indeed experiments suggest that they can respond to light at intensities lower than those detectable by the compound eye. How they do so remains mysterious. This is a staggering revelation of how little we really understand these 'primitive' yet highly complex animals.

Shoaling *Daphnia* are either unaware of the rules of how to react to light or they deliberately flout them. As Trembley observed more than 250 years ago, and Baird unambiguously reported more than a century later, and as more recent observations confirm, shoaling *Daphnia* (and *Moina)* congregate just below the water surface when the sun is shining; that is they have moved upwards into a zone of high light intensity, and there swim in the most brightly illuminated region of their environment, which is contrary to how they might be expected to behave. Moreover, as Baird showed long ago, should a shadow fall on the shoal, it promptly dives *en masse,* which again is contrary to what experiments suggest should be the case, and proceeds to flout the rules even further by again rising to the surface when the shadow is removed and illumination from above increases. If this was their usual behaviour species of *Daphnia* would regularly be encountered swimming just below the surface during the day, which they are not. *D. pulex* and *D. magna* usually shun the uppermost layers of water, and *D. magna* especially often swims and forages near the bottom. Clearly, the impulse to shoal, whatever it is, over-rides normal behaviour.

Other daphniids including species of *Moina* and *Scapholeberis* also form swarms or shoals at times that similarly ignore the rules of how they are supposed to react to light. Pertinent to this matter, the closely related *Scapholeberis* and *Megafenestra* also have persistent habits which necessitate reactions to light that are quite different from those revealed by experiments on *Daphnia*. Members of these genera regularly swim to the surface film and there bring their flat ventral carapace margins in contact with it, suspend themselves from it, and scull beneath it collecting their food. These remarkable habits (the surface film is a serious hazard to some small crustaceans that easily become trapped in it) have involved elaborate morphological specialisations of the carapace margins and their

armature of setae, adjustments to antennary beat, and the development of dark pigment ventrally which confers inverse counter-shading and, perhaps more important, protection against ultra-violet radiation. Ascents to the surface in bright light, and long periods of residence there which are characteristic of these animals, are contrary to the rules of daphniid reactions to light.

How are bird flocks and fish schools co-ordinated?

Just how birds co-ordinate their movements when in flocks is difficult to elucidate, and the literature on flocking behaviour is not very helpful in this respect. While it has much to say on the advantages of flocking, such as the facilitation of food finding and protection against attacks by predators, it is largely silent on the important matter of how movements are organised and how individual birds are able to anticipate the reactions needed to synchronize their behaviour with that of other members of the flock.

The complexity of co-ordination that can be achieved is particularly well shown by such species as the Knot, *Calidris canutus,* and Dunlin, C. *alpina*, large flocks of which not only move at high speed but can rapidly reverse the direction of flight. Leading birds then fall to the back of the flock and former tail-enders become the vanguard. Synchronization can be seen particularly well as a flock turns or swerves and individuals present their dark back and light breast to the observer in quick succession, all individuals appearing to change simultaneously. Clearly vision plays a key role in such co-ordination, but such a statement does not explain how movements are determined or how one individual 'knows' that the flock is to wheel in a particular direction, to rise, or to descend to the ground as if it were a single entity rather than a close-packed aggregation of hundreds or thousands of individuals. What initiates any particular manoeuvre, or how an intention is conveyed to all participants remains largely a mystery.

One line of investigation may have given clues as to the cues employed by such birds, but leaves much to be explained about how the correct responses to these cues are determined. By analysing high speed films of Dunlin flocks it has been found that a single bird may initiate a manoeuvre that spreads through the flock as a wave whose propagation begins relatively slowly then increases to speeds three times as fast as would be possible if the birds were responding to signals from their immediate neighbours. Individuals appear to observe an approaching wave and are ready to respond to it in an appropriate way when it arrives. But what determines that a particular bird should initiate a manoeuvre? And how are responses to cues determined?

A virtually forgotten idea of Selous (1931) is that co-ordinated activities are mediated by thought transference – a concept difficult to test and to which I have found but one subsequent scientific reference, which ridicules it. Selous studied bird flocks intently and was so impressed by the way that, for example, individual Starlings behaved as if they were "component parts of one individual organism" that he asked "how, without some process of thought transference, so rapid as to amount practically to simultaneous collective thinking, are these changes to be explained?". Allee (1938) dismissed the idea as "mythical". However, Howard (1952), who made no reference to Selous, and who made no pretence of having conducted scientific investigations, but who developed a profound rapport with wild birds, believed that thought transference could explain what to her was otherwise inexplicable behaviour, and provided examples. Like Selous she believed that thought transference had been demonstrated in man and that there was no reason to exclude what she called the probability that birds are capable of telepathic communication in a simple form. While scepticism of such beliefs is understandable, it is unscientific to dismiss even apparently outlandish suggestions without investigation. To question a geocentric universe once seemed perverse and stupid, but the supposedly stationary earth is indeed hurtling through space at great speed and revolving as it does so, and is not even the centre of the solar system. Thought transference may seem unlikely but has not been disproved. Indeed, the distinguished physicist Freeman Dyson (2004) believes that there is much evidence that paranormal behaviour exists, but that its manifestations are too fluid

and evanescent to be grasped by the cumbersome tools of science. Without seeking to give credibility to the idea without scientific evidence, or by association, it is worth noting that the remarkable sensory abilities of animals, evident in navigation, migration and communication, give pause for thought. Some animals use a sun compass with a compass-shifting device that continuously and appropriately alters the sun compass angle, or use polarized sky-light. Birds born in Europe migrate across the Sahara without even parental guidance, while others build complicated nests from specific materials without previous experience by what, as a substitute for real understanding, we call instinct, a term that behaviorists now find difficult to define. Likewise bees perform complex 'dances' that guide their hive-mates to sources of food, and even plants can 'remember' that they have experienced winter. Thought transference is not defended here, but should not be dismissed untested. However, even if conceivable in birds, it can surely be ruled out in *Daphnia*!

For fishes, which are well endowed with sensory equipment, there is more information. Co-ordination within a school is believed to be controlled by an integrated system that, as might be expected, includes the lateral line – its 'elimination' leads to collisions – but also the swim bladder, and gas-filled prootic and pterotic bullae of the skull. A moving fish develops a field of force around its body. The fields around adjacent individuals interact in ways that change according to the relative positions of the fishes concerned. These changes are detected and the fishes react accordingly. Vibrations and sounds, between which there is no sharp boundary in water, have a key role. When some fishes make sharp turns, pressure pulses of fast vibrations generated by the initial shortening and fattening of the muscles involved, precede the first signs of movement by a few milliseconds and must give an early warning of incipient movements to adjacent individuals. Subsequent lateral movements of the body generate waves of opposite phase on its two sides and this complex of signals may convey information on the direction of movement and degree of proximity to neighbouring fishes. Sounds generated when fishes accelerate rapidly may provide other useful information. Vision is also important. Individuals can see their immediate neighbours. Herrings reflect flashes of light from their scales as they turn, which are detected virtually instantaneously, and even more subtle information can be transmitted by such means. Some fishes have small areas of high reflectivity at the base of the tail or elsewhere, that can give strong signals to near neighbours. The Horse Mackerel, *Trachurus trachurus,* and Mackerel, *Scomber scombrus,* have localised highly coloured reflecting surfaces of complex microstructure where changes in orientation change the pattern of colours and provide another means of sending information.

Daphnia possesses nothing remotely akin to the sensory equipment of fishes but, as its ability to detect changes in light intensity when deprived of its obvious visual organs shows, we are still groping for understanding here. Its movements are also much slower.

How are shoals organised and controlled?

Swarms are less organised than shoals and presumably easier to assemble, but almost nothing is known about how even swarms are assembled. An obvious possibility is that they are brought together by use of pheromones (chemical attractants) but such tests as been made have found no evidence of these in *Daphnia*.

In considering the organisation and control of a shoal of *Daphnia* the first question must be what initiates aggregation and, to use a military analogy, induces large numbers of individuals to arrange themselves in a well-ordered manner like a platoon of soldiers. On such matters we are as yet ignorant. *Daphnia* and its relatives are not social animals in the accepted sense, but as they often live in close proximity to others of their species they may well be aware of each others' presence even when randomly distributed. Males certainly locate females when this is necessary. Olfactory contact, or an ability to detect vibrations set up by the beating of the antennae are possible, and even if the eye cannot form an image it can conceivably recognise a pattern produced by another *Daphnia*, but these are no more than guesses. Almost everything remains to be learned about how individuals maintain contact. The answers may be surprising. Schroder (1960) showed that the copepod

Mixodiaptomus laciniatus uses a form of echo-location and can find its way through a maze made of transparent plexiglass. Ironically he noted that 'Cladocera' (i.e. *Daphnia* and its allies) locate the same obstacles by touch, which appears to rule out their use of such a system.

If a mechanism of recognition can be identified this will at least give some indication of how aggregation might be initiated. Experiments with, and observations on, groups of *Daphnia* in containers, and even in the field, may yield clues. Individuals could be 'tagged' for observation. Very red animals, in which haemoglobin synthesis has been induced by keeping them in poorly oxygenated water, could be introduced among groups of pale individuals cultured in well oxygenated water, and *vice versa*. This would obviate any risk of bestowing alien olfactory qualities on animals by use of vital stains.

Whatever the stimulus, as soon as a shoal is assembled its organisation is of such a level that it can over-rule normal reactions to light and 'direct' the entire ensemble to the surface, not only in a remarkably co-ordinated way but in an environment that they would normally shun. Moreover, having arrived there, shoaling animals must often swim much more horizontally than is usual.

How movement of a shoal is initiated is unknown, but having begun to do so each member reacts in essentially the same way as its companions, the inference being that all react in the same way to the same stimulus. We have a few clues as to these stimuli. That a shoal often dives when a shadow falls upon it implies a reaction to light, *reduction* of which invokes a negatively phototactic response. Although this is the opposite of the reaction of non-shoaling individuals, it is not difficult to see how it can act virtually simultaneously in each individual. The shore is avoided. Turning by the small shoals of *Moina* is particularly instructive here, but what determines whether the shoal turns left or right is unknown. It may be that it always turns through the most obtuse angle which, as a shoal must seldom approach the shore at a right angle, would answer this question. Simple observations of suitable shoals could confirm or refute this. Clues might be forthcoming from circling shoals – hitherto seen only in clockwise motion in *D. pulex*.

It is obvious that we know very little about these matters and cannot even offer the idea of thought transference as Selous did for birds! Observations by naturalists who find themselves in the fortunate position of having frequent and ready access to shoals could provide vital information.

Why does *Daphnia* form shoals?

There have been suggestions that aggregations of anomopods are related to mating. In cultures microaggregations of *Ceriodaphnia affinis* and *Daphnia carinata*, *c.* 6-7 and 10-12 cm diameter respectively, consisting entirely of females, shed considerable numbers of ephippia when isolated (Brandl & Fernando 1971, Sarantham *et al.* 1977). In both cases, non-aggregating individuals produced no ephippia. Although no males were seen, the production of ephippia implies their former presence, and aggregation for mating, or a post-mating phenomenon, was implied. Why no males were seen is, however, puzzling and in neither case was the existence of what have been called sexual swarms established.

In a small pond, sampled weekly for two years, Young (1978) found that swarms of *D. magna* formed after a time of high population density and persisted for 4 weeks. He says that no swarming took place until ephippial production had reached a maximum and that swarms included a small number of males, which were not found outside them, but the fact that swarms were not formed until ephippial females were numerous, suggests that mating took place elsewhere. Certainly both males and ephippial females of *D. magna* are commonly encountered that are not constituents of shoals, and to refer to swarms that include ephippial females as sexual swarms seems unjustified.

Ratzlaff (1974) saw dense aggregations of *Moina affinis* in a small flood plain pond and, on several occasions, in a dammed river backwater in Pennsylvania, USA. Most striking was their presence on 12 consecutive days in late July, but only in the hot, hazy afternoons, when they formed a continuous line more than 100 m long, about 30 cm from the shore-

line in (to confuse matters!) both shaded and unshaded areas. On the last day of observation, *c.* 9.4 % were males and 13.3 % ephippial females. The rest were parthenogenetic females or (*c.* 8%) immature. Non-aggregated individuals were also present. Of these, *c.* 5% were males, the rest parthenogenetic females or immature. None was ephippial. This suggests that one possible reason for aggregation was to facilitate mating. Ratzlaff also sampled an aggregation in mid-June of the previous year when males comprised about 8% of the population and over 59% were ephippial females. While both males and ephippial females were present in what were probably shoals, the latter being apparently confined to them, and even if mating took place there, this does not necessarily mean that shoals were formed for this specific purpose. Mating commonly occurs in many species without aggregations being formed. Furthermore, while it is not possible to examine every individual, some shoals appear to consist entirely of parthenogenetic females. Moreover, Crease and Hebert (1983) tested *D. magna* to see if males and females were attracted to each other by pheromones. No such were found, nor was either sex affected by the presence of sexually active or receptive members of the opposite sex. Crease and Hebert suggest that any relationship between sexual reproduction and swarming may simply reflect the fact that such reproduction tends to occur at times of high population densities when swarms are most like to be detected.

Certainly sexual reproduction seems to be in no way involved in the co-ordinated behaviour that is the most remarkable feature of anomopod shoals. There is no obvious reason why males should not at times be members of a shoal and participate in its non-reproductive activities, but there seems to be no evidence that either swarms or shoals are formed simply to facilitate mating. This activity certainly occurs commonly among non-aggregated individuals of species in which these phenomena have been observed. If mating demanded the formation of a swarm or shoal, such assemblages would be seen far more often than they are; and how would sparse populations fare? What then is the purpose of these sometimes enormous, organised assemblages?

That shoals constitute epideictic displays merits consideration. Many animals indulge in communal displays or assemblies of various kinds. That these may enable a species to assess its numbers and, by use of this information, take action to regulate the size of a local population and thereby avoid over-exploitation of food and other resources, was advocated by Wynne Edwards (1962), who called such displays epideictic. His idea was severely criticized by some, particularly because such a mechanism would involve group selection. The standard Darwinian view is that natural selection acts on individuals. While embraced by sociobiologists, group selection is still often rejected, regarded with suspicion, or, if conceded, restricted in acceptance to kin selection. But why cannot both kinds of selection operate? Some situations seem inexplicable unless group selection has been involved; for example, how otherwise can the evolution of human language be explained? A word or phrase serves its purpose and survives only if is understood by others, and not just close kin. Nor does it serve the group at the expense of an individual, which some critics seem to think is an inevitable element of group selection. Display of its white tail by a fleeing Rabbit, *Oryctolagus cuniculus*, does not help it to survive, and may even guide a pursuer, but gives a warning to the group of which it is a member. The 'dance' of the Hive Bee, *Apis mellifera,* would be meaningless if its fellow workers did not understand how it informed them of the precise whereabouts of a food source. Naturalists can supply other examples. (Cultural change, human or animal, cannot be explained by *any* kind of selection and is passed on by education or copying.)

Displays require a site at which they can be enacted. Just beneath the water surface is the most effective site for *Daphnia*. It is a natural boundary, easily located by swimming upwards, and here the assembly is conspicuous. To get there involves overcoming the normal reaction to light, which implies strong motivation. Wynne Edwards indeed suggested that nocturnal accumulations of planktonic animals near the surface in species that undergo diurnal vertical migration constitute epideictic displays. However, such accumulations appear not to be organised into integrated assemblages and their nocturnal

nature means that visual recognition is ruled out or reduced in effectiveness. More convincing are the sub-surface assemblies of the marine copepod *Calanus finmarchicus*, reported by many observers, summarised by Marshall and Orr (1955) and mentioned by Wynne Edwards. Enormous numbers are involved in these summer gatherings that are present by day and even in bright sunshine, as are *Daphnia* shoals. They sometimes colour the sea red by virtue of their carotenoid pigments. They have no haemoglobin. These assemblages appear not to be regimented as are shoals of *Daphnia*. From time to time members bump against the surface film and, in calm conditions, produce expanding circular ripples like miniature versions of those caused by 'rising' fishes – themselves regarded as epideictic displays by Wynne Edwards.

While it is tempting to regard *Daphnia* shoals as epideictic displays, even if they serve as such we have no idea how any information obtained could be acted upon, and there are reasons for regarding any such role as improbable. *Daphnia* has a built–in population regulating mechanism that makes such a display un-necessary. Parthenogenetic females produce a succession of clutches of eggs throughout their life. Potential clutch size differs according to size. Large females can brood more eggs than small. Clutch size also reflects the availability and quality of food. Abundant food of good quality engenders large clutches: sparse or poor quality food, small clutches. Large *D. pulex* can produce clutches of 50 to 80 eggs, but at times as few as one to three. In cultures supplied with abundant, nutritious food, large *D magna* can produce clutches of over 100 eggs, but very small clutches when food is scarce. In both species egg production may cease in times of adversity. Large clutches are often produced early in the year by large over-wintering females even at low temperatures, at which time populations tend to be sparse and competition for food probably slight. Reproductive rates are therefore geared to food supply in a more obvious manner than in most animals. Laboratory studies have indeed shown that at any given temperature, population size is determined exclusively by food increment.

Daphnia can also react to adverse conditions, which include scarcity of food, by switching from parthenogenetic to sexual reproduction. Males are produced and mate with females, which then produce ephippial (resting) eggs. Long-term stability of populations is indeed less important than in many animals. Survival is ensured by resting eggs, and beneficent conditions are exploited by high fecundity of parthenogenetic females. *Daphnia* therefore seems to have an excellent mechanism for adjusting reproductive output to prevailing conditions without the need for epideictic displays, and there is no convincing evidence that shoals (or swarms) serve as such.

Young *et al.* (1994) found a persistent swarm of *D. longispina* under a bridge over a pond (quite different behaviour from that of a shoal) in two consecutive years. They suggested that, under certain conditions, the swarm as a whole may benefit, and not just individual participants, and that aggregations consisting of clone-mates may be favoured. That is, kin selection may operate. This argument could, but less convincingly, be extended to shoals. Tests, using just one enzyme system, showed that the swarm consisted largely of members of a single electrophoretic clone, which supported, but did not provide positive evidence in favour of, this idea. However, Mitchell *et al.* (1995) analysed *D. magna* from five swarms (and three non-swarming samples) in a German pond (where they suspected that swarming granted protection against fish predation) and found that the swarms included members of from 10 to 14 electrophoretic clones (non-swarmers 8 to 16). This provided convincing evidence against the association of kin. They also made the pertinent comment that *Daphnia* may be unable to recognise clone-mates, though they did not rule out this possibility.

No explanation of why *Daphnia* forms shoals can yet be given. Shoals are social in nature and some benefit presumably accrues to participants or they would not have evolved. What these benefits might be is obscure. Even if it applies to swarms, which is unproven, defence against predators seems highly improbable. Shoals frequent the warmest layer of water – which solitary animals do not. This increases their metabolic rate, which

may or may not be advantageous, and speeds reproduction. However, as many populations are essentially ephemeral and die out or are greatly reduced in numbers in winter, which can in any case be survived by resting eggs, the value of any such boost is debatable.

A recently discovered complication: multispecific shoals

A further complication of aggregations of anomopod water fleas is that sometimes more than one species may be present. From Glubokoe Lake, near Moscow, Russia, Kotov (2000) described what, from its compact nature and the fact that it was moving purposefully offshore, can be characterised as a shoal of the daphniid *Scapholeberis mucronata*. While this species dominated the assemblage, smaller numbers of three species of *Ceriodaphnia, Megafenestra aurita* and *Bosmina longirostris* all of which are open-water swimming species, were also present. So too were a few *Chydorus sphaericus*, a basically benthic/weed frequenting species of great versatility that sometimes ventures into open-water, and, even more surprising, a few representatives of four other chydorids including *Peracantha truncata* which, while an able swimmer, is specialised for crawling over surfaces, often of plants. The shoal was confined to the upper 10 cm of the 1.2 m water column. Kotov had seen a similar mixed shoal two days earlier, which prompted his careful examination of the one described, and a few days later sampled two more aggregations and found them to consist exclusively of *S. mucronata*. His explanation of the mixed assemblages was that they offered protection against juvenile fishes and larvae of the midge *Chaoborus*, both of which were numerous. This is a plausible explanation for the open-water species, but what induced several species of normally bottom-frequenting chydorids to join the shoal is profoundly mysterious. Kotov's suggestion was that the shoal of *S. mucronata* had attracted inshore species that had similar tendencies to aggregate, or perhaps by means of pheromones. The employment of the latter has yet to be proved, and such a broad spectrum pheromone would be unusual in an attractant. It is alarm substances that usually have this property.

Considerable numbers of the onychopod *Polyphemus pediculus* (q.v.) also accompanied the shoal but were regarded by Kotov as undoubtedly having been attracted to it by potential prey.

It is uncertain whether swarms of *Daphnia* always consist of one species only. More information is needed. It seems unlikely that a co-ordinated shoal would include more than one species other than as 'hangers on', but again information is lacking.

The shoaling of *Polyphemus Pediculus*

There is another small branchiopod crustacean that is a persistent shoal former. *Polyphemus pediculus* (Fig. 8) belongs to the order Onychopoda, regarded by some as not distantly related to the Anomopoda. However, apart from employing the antennae as oars and having a single eye, its anatomy differs profoundly from that of anomopods. Antennal locomotion is an ancient practice retained from that of the nauplius – the ancestral crustacean larva – as it is in many of the very different ostracods and some copepods. The eye of *Polyphemus*, described in detail by Nilsson and Odelius (1983) and Odselius and Nilsson (1983), is vastly different from that of *Daphnia*, and extremely complex. It has 130 precisely arranged ommatidia some of which have specialisations (a layered rhabdom) unknown in other 'primitive' crustaceans, and is capable of acute vision.

Unusually for a shoaling species, but like certain schooling fishes, *Polyphemus* is a predator. Except when very young, it feeds on small daphniids, their smaller relative *Bosmina*, copepods, first instar (planktonic) chironomid larvae, rotifers and protozoans. Its shoaling habits have long been known in a general way but have received detailed study only by Ludmilla Butorina, many of whose findings have been published in Russian. Chasing of prey was studied by Young and Taylor (1988), who make no mention of shoaling.

The shoaling behaviour of *Polyphemus* differs greatly from that of *Daphnia*. Its often near habitual shoaling is remarkable for such a supposedly 'primitive' crustacean and bears comparison with that of social and partly social insects. While individuals regularly stray

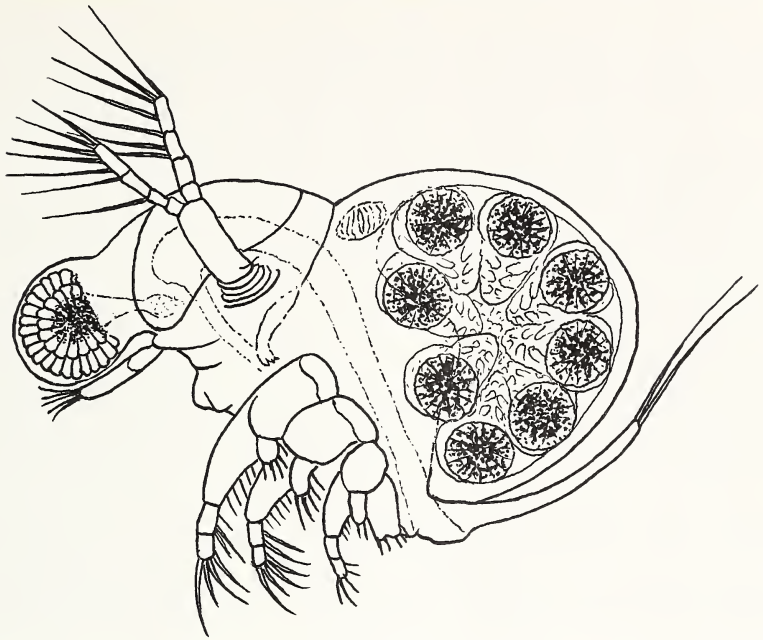


FIGURE 8.
Polyphemus pediculus (length *c*. 1.2 mm.). A parthenogenetic female swimming; each dark object in the brood pouch is the eye of a developing embryo.

from shoals, and in some places it appears to lead an independent existence, Butorina's work suggests that shoaling is more persistent than generally thought. In the populations that she studied, its entire biology is dominated by these habits. It forms distinctly contoured aggregations, often among submerged vegetation that extends almost to the surface. By day these are concentrated by preference in the upper 5 cm or so of water, below which their abundance declines gradually between *c*. 5 and 15 cm then sharply to about 25 cm or sometimes more. In vertical section therefore, aggregations are more or less mushroom or wineglass shaped. They may be circular in plan, mostly 20 cm or more in diameter, but sometimes smaller. More often, however, they are oval, usually *c*. 18 cm long and 9 to 12 cm wide, but smaller and sometimes much larger, assemblages are formed. Several shoals may be present in a square metre of water. Their members do not move around in the relatively slow co-ordinated manner of shoaling *Daphnia* but in what, presumably deceptively, appears to be a chaotic manner that Butorina (1986) likens to Brownian motion, but which does not disturb the contours of the shoal. There is also continuous movement of solitary individuals between shoals.

As Butorina has shown, a remarkable feature of shoals is that they generally frequent the same place throughout an entire summer. When a shadow falls from a nearby object as the day progresses a shoal may move about half a metre, but by the following day is back on station. By labelling with radioactive carbon it has been shown that animals which leave a shoal may move as much as 25 m and then join another shoal and that they generally swim quickly when alone. Feeding takes place only in the light, and experiments have shown that the feeding intensity of members of a group is about 3 to 3. 5 times as great as that of solitary individuals. It is clearly advantageous to frequent an aggregation.

A remarkable feature of the behaviour of *Polyphemus* is that individuals involved in reproduction gather together within the shoal as denser aggregations – rather like the nucleus of a cell (Butorina 2000). Females reproducing by parthenogenesis congregate near its centre, mostly within the upper 5 cm of water in a spherical or vertically more elongate cluster, where they tend to swim in circles around each other. Release of young is largely synchronized, about 80% being released in a 2-hour period very early in the morning. After its last juvenile has been released a female returns to the main shoal.

Aggregations in which males and females mate form in the upper few centimetres of water as smaller, denser, and therefore darker, spherical clusters than those of parthenogenetic females. These arise suddenly, persist for about an hour, then break up equally suddenly. Their members disperse within the main shoal but, as radioactive labelled individuals reveal, tend to leave it and join other shoals.

Females ready for laying fertilized resting eggs form spherical aggregations that are larger and less dense than mating clusters, and lie deeper in the water. Because the shoal remains in the same place throughout the season, gametogenetic females, which, uniquely among so-called cladoceran branchiopods, deposit their eggs on substrata, lay them in a communal site, often on aquatic plants or filaments of algae. Presumably the females that deposit the first resting eggs of the season select a site and subsequent females follow suit. Large numbers of eggs therefore accumulate there. Spent gametogenetic females leave the shoal and soon die.

As this brief account, based on the work of Butorina, shows, shoaling in *Polyphemus* differs in many respects from that in daphniids. Two questions pose themselves. *Polyphemus* often frequents lakes where fishes are plentiful. Although small, they are conspicuous animals and one wonders how they avoid predation. As shoals are so permanent, procuring of food presumably involves brief dashes from the shoal to seize passing prey.

A word in conclusion

We are still very ignorant about almost everything relating to shoaling by *Daphnia* and other anomopods. It is not a phenomenon that can be studied in the laboratory, though some aspects of *Daphnia* behaviour that can be so studied may throw light on it. The formation of shoals appears to be capricious and, as yet, unpredictable, which means that field observations are, of necessity, likely to be largely opportunistic. However, there may be favoured sites at which shoals appear with regularity that, if located, would provide opportunities for observations, and perhaps simple experiments. Even chance encounters can do so to a naturalist alerted to the possibilities. A garden pond may provide an ideal site!

We need observations on the size, 'thickness' and shapes of shoals, on shape changes or constancy, and speed of movement; information on conditions at the time of shoaling, the duration of a shoal, whether it breaks up at night, whether it includes males or ephippial females, its reactions to disturbances of different kinds, whether it can re-unite if divided, or will not tolerate such interference, whether its members are always richly endowed with haemoglobin; if it dives what was the stimulus; how deep does it descend, and for how long. Photographs would be helpful (a polaroid filter would help) and video records of shoals in action may prove invaluable.

If close observation is possible, details of the spacing of individuals in a shoal, their reactions to neighbours, whether they ever touch them, whether they remain close to one set of neighbours or move within the shoal are much to be desired. Shoaling provides the opportunity for individuals to obtain, and act on, information from others, and it is only by discovering how shoaling animals react to each other that we can even begin to consider such matters.

Acknowledgements

I thank Dr G. A. Boxshall who kindly read my manuscript and made helpful suggestions, and Dr Ludmilla Butorina for information on *Polyphemus*.

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BOOK REVIEWS

Bush Seasons. An affectionate study of a Tiny Bushland by **Joan Semmens.** Pp. viii + 320, Hyland House, Flemington, Australia, 2002. £23.99 hardback.

This book gives an account of the flora and fauna of a 100 acre (45 hectare) reserve in the foothills of the Great Dividing Range in S.E. Australia that, almost miraculously, survived the assaults that beset the surrounding land as white settlers and gold diggers replaced the Aborigines who formerly lived there in harmony with their environment. It is a remnant of a once widespread type of vegetation classified as Grassy Woodland, only about 2% of which remains, most of it severely degraded. Part of the reserve recently survived a threat of being used as a landfill site, and now all seems secure. Although a splendid repository of native plants, over 30% of those recorded are aliens that have arrived since Australia was colonized by Europeans.

Most of the book takes the form of a seasonal diary in which plants are listed, with relevant comments, in order of flowering, accompanied by many full-page, life size, watercolour illustrations. Also illustrated are fungi, a few lower plants, and a variety of insects, mostly butterflies. Six plates portray all the birds recorded, and the text is enlivened by line drawings, most of vertebrates.

To a European it is the alien nature of the native plants that is most striking. Nowhere is this better revealed than by the orchids, of which no fewer than 25 species, plus varieties and hybrids, are listed and illustrated. All belong to non-European genera, and the attractive illustrations bring home to the reader the amazing diversity of this remarkable family, whose Australian representatives appear to be almost as distinctive as its mammals.

While few non-Australians will read the entries for every plant, all can enjoy, and learn from, the illustrations with which this informative book is so well endowed.

GF

Guide to the Identification of Soil Protozoa – Testate Amoebae by **K. J. Clarke.** Pp. 40 with numerous line drawings. Freshwater Biological Association, Ambleside, 2003. £8.00 paperback.

An excellent short introduction to testate Amoebae (Amoebae with shells) that occur in prodigious numbers in ponds, damp soil, and almost wherever a film of water exists. There are clear line drawings of the tests of 90 species that give a good idea of the diversity of these structures. Used in conjunction with the *Atlas* of Ogden and Hedley (1980), which employs photographs of tests seen with a scanning electron microscope, a beginner will be well equipped to embark on a study of these abundant and fascinating one-celled animals.

GF

THE LICHEN FLORA OF HULL, WITH PARTICULAR REFERENCE TO ZONAL DISTRIBUTION AND ENVIRONMENTAL MONITORING

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Introduction

The role of lichens as environmental monitors is widely recognised. Not only are they valuable as indicators of habitat stability and environmental continuity, but they are also effective in monitoring environmental quality, more particularly air and soil (and more recently water) pollution. In the past, the main role of lichens in this context has been to monitor sulphur dioxide air pollution, especially stable and rising levels (Seaward 1993). However, it has also been shown that lichens are effective monitors of falling levels of gaseous sulphur dioxide and indeed of other pollutants, some of which are manifesting themselves as a consequence of the reduction in the former; of particular interest in this respect is the use of lichens to detect and determine the extent of qualitative changes in air pollution such as the impact of acid rain and hypertrophication (Seaward 1997; Seaward & Coppins 2004).

Historical context and baseline surveys

The establishment of baseline information through detailed lichen surveys adopting rigorous protocols is crucial for such monitoring programmes. Despite the establishment of an elaborate national database of lichen mapping by the British Lichen Society in 1963, Hull has received limited coverage; furthermore, little is known of its lichen flora prior to this date as it appears to have been overlooked by naturalists and at Yorkshire Naturalists' Union field meetings despite the county having 300 years of lichenological recording (Seaward 1987). Only one record specifically localised to Hull has been found in published or herbarium sources, namely *Ramalina siliquosa,* represented by a specimen (now in Dublin herbarium) collected by W. G. McIvor in 1844-45 (Seaward 1976); this is a interesting record since this species is found on maritime rocks (and occasionally timber); even today, this species is rare in eastern England north of the Humber and absent to the south of it.

During 1967 to 1970, B. J. Coppins, then an undergraduate at the University of Hull, produced a preliminary list of East Yorkshire lichens, but this contains only a few species for the city. Later, D. H. Smith visited the city as part of the BLS national churchyard survey, listing 17 species at Sutton-on-Hull in 1990 and 17 species at Hull Spring Bank (Western Cemetery) in 1995. However, this earlier work was almost entirely based on studies of saxicolous species and so does not provide an adequate baseline from which to gauge any form of environmental impact other than the total disappearance of the particular habitat studied.

However, a better picture of the lichen flora in the rural areas surrounding the city (i.e. within 5 km of its boundary, see below) can be determined from work undertaken mainly by B. J. Coppins, D. H. Smith and M. R. D. Seaward over the past 35 years; this can be used for comparative purposes in the evaluation of the city's current and potential biodiversity.

Current Surveys

Three days of intensive fieldwork by the author in February 2002 provided credible baseline data for (1) judging the current status of the city's lichen flora and determining the major factors affecting it, and (2) critically evaluating future impacts, deleterious or

favourable, on that flora; this work was followed up by several day visits by the author in 2003 and 2004. The survey work undertaken in 2002 was presented as an unpublished report to the Hull Biodiversity Partnership (Seaward 2002) and the preliminary conclusions used in the lichen section of the *Hull Local Biodiversity Action Plan* (Marshall 2002).

There was clear evidence from this work that the city's lichen flora reflected atmospheric amelioration in terms of sulphur dioxide (complementing data derived from pollution gauges; see Kingston upon Hull City Council 2000, section 3.5), but also showed increased hypertrophication. Both these processes, which are widespread in Britain, and indeed Europe, have been detected by lichenological surveys (Seaward 1993, 1997; Seaward & Coppins 2004), but their stage of development cannot be accurately gauged for Hull due to the limited baseline information. The implementation of clean air policy and practices has undoubtedly impacted on the city's lichen flora as measured by the increase in biodiversity, particularly of epiphytic species, but there has also been a qualitative (as well as quantitative) shift, the prevailing species in a wide variety of habitats being reflective of extensive hypertrophication.

These surveys investigated a wide variety of habitats: corticolous (tree trunks and twigs) and saxicolous (stonework, brickwork, cement and other man-made substrata) proved most rewarding, but muscicolous (over mosses) and lignicolous (timber), even when impregnated with nutrient-enriched (mainly nitrogenous) dusts, were disappointing, and terricolous (on soil) species were non-existent.

The fieldwork was based on zonal and transect studies, the former radiating from the old city centre, and the latter extending (according to accessibility) more-or-less along five compass points to the W, NW, N, NE and E; in each case as many of the above-named habitats/substrata as possible were investigated, but most attention was paid to epiphytes.

In all, 54 taxa were recorded by the author from the city during the past two years (Appendix A), which compares favourably with the biodiversity (155 taxa) of the lichen flora of the surrounding rural areas within 5 km of the city boundary.

Zonal Study

On the basis of the epiphytic flora, the city can be clearly demarcated into three zones (Figure 1): an **inner zone** (**I**) of 1 to 4 species, an **intermediate zone** (**II**) of 5-8 species, and an **outer zone** (**III**) of more than 8 species; the variation in biodiversity within a zone and the abundance/percentage cover on a particular substratum are related to air quality in general and more particularly to the level of hypertrophication. Further variations relate to (a) habitat, mainly exposure *v*. shade, (b) tree species, (c) vandalism, and (d) inclination of the trunk. Many commonly planted trees, such as plane, beech, cherry and hawthorn are poor for lichens. Trees at a slight angle to the vertical often provide a more favourable habitat for epiphytes. In the past, only mature trees would be examined in such surveys, but, rather interestingly, some relatively young trunks occasionally support several species; similarly, twigs, also previously overlooked in urban surveys, should be examined since they frequently support species indicative of hypertrophication (Seaward & Coppins 2004).

As well as diversity counts, attention was also paid to the height to which particular species, and lichens in general, reached on the trunk; in both cases, these measurements were important in defining pollution zones, and with a more elaborate definition could be used to subdivide the three zones mentioned above, but the level of hypertrophication requires qualification as it complicates factor interpretation.

Generally speaking, the epiphytic flora of the **inner zone** (**I**) is composed of one alga (*Pleurococcus*) and one or two ill-defined crustose species, including *Lecanora conizaeoides* (often infected by the fungus *Athelia arachnoidea*); however, it must be pointed out that *L. conizaeoides*, which for the past 50 years has dominated urban environments, is now on the decline (in Hull it is only occasionally found in fruit, mainly when growing on timber fencing); additionally, according to the level of hypertrophication, one or more of the following foliose species are to be found: *Physcia adscendens*, *Phaeophyscia orbicularis* and *Xanthoria parietina*, and rarely (e.g. Victoria Pier) *X. polycarpa*.

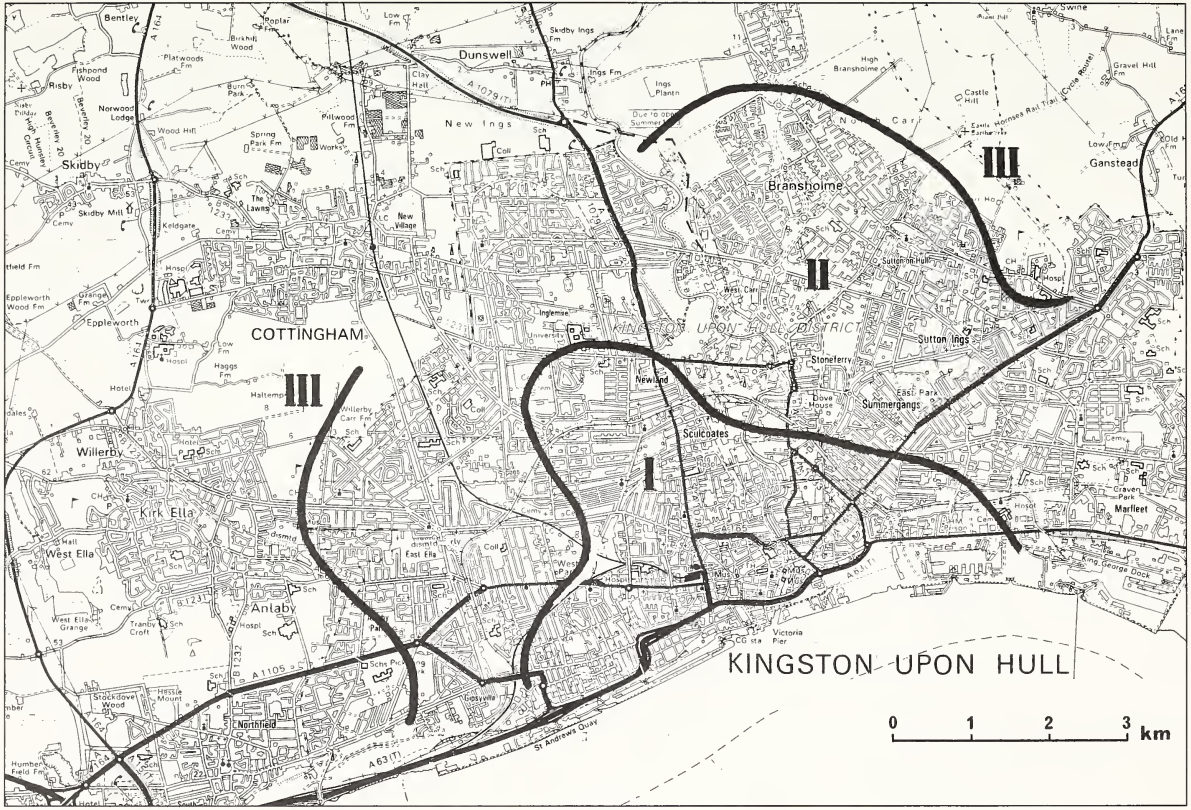

FIGURE 1.
Kingston upon Hull: air quality zones (I to III, with decreasing air pollution burdens) delimited on the basis of lichen surveys, February 2002-February 2004 (superimposed on 1992 OS map, with permission).

The epiphytic flora of the **intermediate zone** (**II**) is composed of all of those species found in the inner zone together with *Parmelia sulcata* (rarely *Hypogymnia physodes* and/or *Lecanora expallens*) and, according to the level of hypertrophication, one or more of the following: *Lecanora dispersa* and *L. muralis* (tree bases only), *Physcia caesia*, *P. tenella*, *Physconia grisea* and *Xanthoria candelaria*.

The epiphytic flora of the **outer zone** (**III**) is composed of all of those species found in the inner and intermediate zones (although *Pleurococcus* and *Lecanora conizaeoides* are less frequently encountered), with the addition of one or more of the following: *Amandinea punctata, Candelariella reflexa*, *Evernia prunastri*, *Flavoparmelia caperata*, *Hypotrachyna revoluta*, *Melanelia fuliginosa* ssp. *glabratula, M. subaurifera*, *Punctelia ulophylla*, *Phlyctis argena* and *Ramalina farinacea*.

In terms of the radial transects, the lichen flora (particularly the epiphytes) significantly improves with distance from the centre of the city in all directions, with the exception of the easterly route where only a marginal improvement was detected; it was also noticeable that along the westerly route the epiphytic flora improved almost to the optimum detected anywhere in the city, only to decline at *c*. 200 m from the city boundary approaching Hessle.

This survey work was undertaken at a critical time in terms of the recovery of the city's lichen flora, as demonstrated by the short-term shifts in distribution and habitat extension within the space of only two years. It should be noted that urban environments provide an artificially high and remarkable array of habitats and substrata, and that once the prevailing factor (air pollution) dictating the lichen flora has been alleviated, such an environmental diversity will naturally be exploited by lichens.

Although much of the work concentrated on the epiphytic flora, attention was also paid to the wide variety of other substrata to be found in urban environments. Currently, urban distribution patterns are less easily discerned for those species found on saxicolous and lignicolous substrata, although biodiversity counts in particular habitats and autecological studies of selected species (e.g. *Lecanora muralis*) have proved useful in the past for bioindicational scales of air pollution monitoring (Seaward 1976a). In all, 24 saxicolous and one lignicolous species were recorded, but it should be noted that many of the former were also to be found on dust impregnated (often nutrient-enriched) living and dead wood substrata. Truly maritime species on shoreline sea defences (stone- and timber-work) were not encountered and maritime influences on the lichen flora in general were undetectable; no terricolous species were recorded during the current surveys.

A complete inventory of the 54 lichens recorded on this survey is provided in Appendix A, together with details of the zones (I, II and III) in which they occur, the substrata on which they were recorded and some level of overall frequency.

Conclusions

Despite there being no previous baseline study, it is clear from this work that the lichen flora of Hull is undoubtedly recovering as a result of atmospheric amelioration, and that future recolonisation studies of particular species and assemblages will be rewarding in order to determine air quality, the extent of hypertrophication and other human disturbances. Although there are no Red Listed lichen species in need of conservation action, there are habitats supporting relatively rich and improving lichen floras which merit special consideration, such as the mature trees and thickets on golf courses and on roadsides with wide verges. The diverse lichen floras associated with some of the city's older buildings (e.g. churchyards and old brickwork) should also be considered in terms of their lichenological as well as historical value. Rejuvenation areas are also not without lichenological interest, particularly those along the coastline where, for example, the harshness of building work will be softened over time by a mosaic of lichens. Due to their longevity, lichens could also be suitable for monitoring the stability of sea defences.

Acknowledgements

The author is grateful to Dr Brian Coppins and Don Smith for providing him with their lichen record cards for the period 1967-1970 and to Jon Capel (City Ecologist) and Bethany Marshall of the Hull Biodiversity Partnership for their interest in and support of this work and for providing funds to cover the fieldwork undertaken in February 2002.

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APPENDIX A.

Checklist of lichens currently recorded by the author, 2002-2004, within Hull city boundaries, with details of zonal distribution (I, II, III – see text), substrata and frequency

Acarospora fuscata I, II, III, brickwork & acid stone, occasional
Amandinea punctata III, tree trunks, occasional
Caloplaca citrina I, II, III, calcareous substrata, locally frequent
C. decipiens I, II, III, calcareous dusty substrata, infrequent
C. flavescens II, III, calcareous substrata, uncommon
C. flavocitrina I, stone sea defences, locally frequent
C. holocarpa II, III, calcareous substrata, occasional
C. saxicola I, II, III, calcareous substrata, occasional
Candelariella aurella I, II, III, calcareous substrata, locally frequent
C. reflexa III, tree trunks, occasional
C. vitellina I, II, III, acid stonework, locally frequent
Catillaria chalybeia I, tops of timber wave breakers, rare
Evernia prunastri III, tree trunks, infrequent
Flavoparmelia caperata III, tree trunks (mainly *Salix*), occasional
Hypogymnia physodes I (very rare), II, III, tree trunks, occasional
Hypotrachyna revoluta III, tree trunks (mainly *Salix*), rare
Lecania erysibe I (coastal), II, III, calcareous substrata, occasional
Lecanora albescens I, II, III, calcareous substrata, locally frequent
L. campestris II, III, calcareous substrata, occasional
L. conizaeoides I, II, III, tree trunks, timber, stonework, etc., common (but declining)
L. crenulata I (rare), II, III, calcareous substrata, occasional
L. dispersa I, II, III, calcareous substrata, locally common (rarely on bases of trees)
L. expallens I (very rare), II, III, tree trunks, infrequent but widespread

L. muralis I, II, III, stonework, cement & tree bases, locally frequent
L. polytropa II, III, acid stonework, occasional
Lecidella scabra I, II, III, stonework, infrequent
L. stigmatea I, II, III, calcareous stonework, locally frequent
Lepraria incana s.l. I, II, III, tree trunks & acid stone, locally frequent
Melanelia fuliginosa ssp. *glabratula* III, tree trunks & branches, infrequent
M. subaurifera III, tree trunks, occasional
Parmelia sulcata I (very rare), II, III, tree trunks, infrequent
Phaeophyscia nigricans II, III, calcareous substrata, occasional
P. orbicularis I, II, III, tree trunks, stonework, etc., very common
Phlyctis argena III, tree trunks, rare
Physcia adscendens I, II, III, tree trunks, very common (rarely on calcareous substrata)
P. caesia I, II, III, tree trunks & stonework, locally frequent
P. dubia III, tree trunk bases, infrequent
P. tenella I (less frequent), II, III, tree trunks, locally frequent
Physconia grisea I (very rare), II, III, tree trunks, occasional
Porpidia soredizodes II, III, acid stonework, rare
P. tubulosa II, III, acid stonework, infrequent
Psilolechia lucida II, III, acid stonework, occasional
Punctelia ulophylla III, tree trunks (mainly *Salix*), rare
Ramalina farinacea III, tree trunks & branches, rare
Rinodina gennarii I, II, III, stonework & brickwork, infrequent
Scoliciosporum chlorococcum II, III, tree trunk bases, occasional (but overlooked)
S. umbrinum II, III, calcareous substrata, occasional
Trapelia coarctata II, III, acid stonework, infrequent
Verrucaria macrostoma f. *furfuracea* II, III, calcareous substrata, occasional
V. muralis II, III, calcareous substrata, infrequent (probably overlooked)
V. nigrescens II, III, stonework, infrequent (probably overlooked)
Xanthoria candelaria II, III, tree trunks (especially bases), locally frequent
X. parietina I, II, III, tree trunks & twigs, stonework, etc., common
X. polycarpa I (rare), II, III, tree trunks and twigs, infrequent but widespread

THE BEETLES OF SPURN PENINSULA: A SECOND UPDATE

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The Beetles of Spurn Peninsula (Denton 1995) was updated by Denton (1997), who brought together a number of archival records that were not previously available. At that time a total of 729 species had been recorded from this important Yorkshire Wildlife Trust reserve. Since then a small number of coleopterists, including the author, have continued to collect along the Peninsula, and these excursions have resulted in records which have added to the known distribution or, in some cases, added new species. Due to a small number of inaccuracies in Denton (1995), the deletion of *Oxypoda exoleta* Erichson and *Stenus formicetorum* Mannerheim, the addition of two water beetle species (Butler & Popham 1958) and recent additions of other species, the Spurn List of Coleoptera now stands at 731 species.

In compiling the list which follows I am greatly indebted to the following collectors and recorders: P. M. Butler (PMB), W. R. Dolling (WRD), M. Hammond (MH), C. Johnson (CJ), P. Kendall (PK), F. E. Kenington (FEK), R. Merritt (RM), E. J. Popham (EJP), E. J. Smith (EJS) and B. R. Spence (BRS). All references to the 'initial survey' refer to the YNU Entomological Section visits between 1947 and 1953 (organised by the late W.D. Hincks) and all locality names mentioned will be found on the maps in Denton (1995). All dated modern records are those of the author unless stated otherwise. Nomenclature follows Pope (1977) or more recent revisions.

Leistus rufescens (Fabricius). Specimens located at Chalk Bank on 14/8/01 add to the known distribution. All previous records had been from the Warren.
Nebria brevicollis (Fabricius). A single at the Warren on 29/9/99 constitutes the second record, the other being from the edge of the 'Canal Scrape' on 20/6/90.
Loricera pilicornis (Fabricius). Examples found in pitfall traps at the 'Narrow Neck' on 14/8/01 provide only the second record, the other being a single found in the 'Canal Zone' in 6/51.
Bembidion lampros (Herbst). Specimens located at Chalk Bank on 14/8/01 constitute the first record since the initial survey and add to the known distribution. The previous records were from the Warren and 'marsh meadow'.
Bembidion obtusum Serville. A single to the north of the 'Sheep Field' on 9/7/01 adds to the known distribution. All previous records were from the Warren and 'Clubley's Field'.
Bembidion guttula (Fabricius). Examples found in pitfall traps at Chalk Bank on 14/8/01 constitute the second record, the previous one being from the *Phragmites* marsh during the initial survey.
Calathus melanocephalus (Linnaeus). Specimens from Chalk Bank on 17/8/01 (RM det. EJS) add to the known distribution. With the exception of specimens from an unknown location on 21/7/63, all previous records were from the Warren area.
Agonum marginatum (Linnaeus). Specimens located along the pond edges in 'Clubley's Field' on 17/8/01 (RM) added this species to the Spurn List. The species is locally distributed in marshy places, bare mud at the sides of ponds and lakes, and on muddy coasts.
Amara bifrons (Gyllenhal). Specimens from pitfall traps south of the 'Narrow Neck' on 14/8/01 constitute the third record, the previous being from the Humber foreshore (exact location unknown) on 17/7/48 and near the 'Crown and Anchor' (technically speaking 20m north of the recording area). This is a locally common species of dry soils, which occurs over much of Britain, but is less common in the north.
Amara lucida (Duftschmid). Singles located in the 'Sheep Field' on 15/6/01, north of Chalk Bank on 9/7/01 and near the Lighthouse on 14/8/01 constitute the fourth to sixth

records. The others were from unrecorded locations on an unrecorded date and 6/28 and Chalk Bank on 30/5/92. The species is afforded Notable B status and is only known from three other widely scattered Yorkshire localities (only two of these being since 1970).

Amara ovata (Fabricius). A single found in a pitfall trap at the 'Narrow Neck' on 9/7/01 constitutes the third record and adds to the known distribution. The other records concerned singles found along the Main Ridge in 6/51 and in the Warren area during the same month.

Amara tibialis (Paykull). A single located in a pitfall trap in the 'Sheep Field' on 9/7/01 constitutes the first record since the initial survey when a number of records were made but only one location, Chalk Bank, is mentioned where it was said to be common during the summers of 1947, 1948 and 1951. Although widely distributed in the British Isles, this species is more local in the north, and within Yorkshire is restricted to the eastern half of the county.

Harpalus rufipes (De Geer). Specimens from the 'Narrow Neck' and to the north of Chalk Bank on 9/7/01 and the Point on 4/7/03 (PK) add to the known distribution. The previous records were from the Warren on 17/7/48 and 8/6/50 and the edge of 'Canal Scrape' on 20/6/90 and 2/5/93.

Harpalus rufibarbis (Fabricius). Examples from pitfall traps in the 'Sheep Field' and to the north of Chalk Bank on 14/8/01 add to the known distribution. All previous records, with the exception of one from an unrecorded location in 1919, were from the Warren northwards.

Harpalus latus (Linnaeus). Several specimens were found in pitfall traps at the 'Narrow Neck' on 9/7/01 and 14/8/01 and near the Lighthouse on 14/8/01. The previous records were from an unrecorded location on 22/7/63, the Point on 3/7/66, on the road south of the Warren on 1/5/93 and on the Humber shore south of the Warren on the same date.

Dromius quadrinotatus (Zenker in Panzer). A single found in a pitfall trap at Chalk Bank on 12/7/01 provides the fourth record and adds to the known distribution. The other records were from the *Phragmites* marsh on 13/8/66, in grass cuttings at the Warren on 22/6/90 and in old straw in 'Clubley's Field' on 21/11/90. Normally found in association with fir trees, these are most unusual habitats for the species.

Metabletus foveatus (Fourcroy). Four specimens found in pitfall traps in the marram at the Warren on 13/7/01 constitute the third and only recent record, the others being from the Humber shore (exact location unknown) and the Warren during the initial survey. Although very common in much of southern Britain, the species becomes more local northwards and is rare in Scotland. Although widely distributed in Yorkshire, it is generally confined to low-lying areas.

Haliplus lineatocollis (Marsham). Specimens located in the 'Bomb Crater Pond' and adjacent ditches on 17/5/01 (MH) constitute the fourth record, the previous records being from the pond near the *Phragmites* marsh on 3/5/50 and 5/6/50 and the 'Bomb Crater Pond' on 1/7/93.

Laccophilus minutus (Linnaeus). Specimens from 'Pallas's Pond' on 2/11/99 (MH), the ponds in 'Clubley's Field' on 17/5/01 (MH) and 17/8/01 (RM) constitute the third to fifth records. The previous records were from 'Pallas's Pond' and the 'Bomb Crater' during the initial survey.

Agabus bipustulatus (Linnaeus). During the initial survey this species was encountered in the 'marsh meadow', the 'Canal' and in a static tank at the Warren. Examples found in the ponds in 'Clubley's Field' on 17/8/01 (RM) constitute the third recent record, the others being singles from 'Pallas's Pond' and two ditches near the 'Canal Scrape' on 1/7/93.

Agabus conspersus (Marsham). Previously recorded from the 'Boundary Dyke', the pond near the Humber shore and the 'Canal', this species was located in 'Pallas's Pond' and the 'Canal Scrape' on 2/11/99 (MH), the 'Bomb Crater Pond' and adjacent ditches on 17/5/01 (MH) and the ponds in 'Clubley's Field' on 17/5/01 (MH) and 17/8/01 (RM).

Ilybius fuliginosus (Fabricius). Specimens were found in the 'Boundary Dyke' and in a pond in the 'marsh meadow' in 7/53 (PMB and EJP). In 7/54 they were still extant in these

areas and also located in the 'Canal' and the *Phragmites* marsh, including the nearby pond (PMB and EJP). There are no recent records.

Rhantus suturalis (MacLeay). Specimens were found in the 'Boundary Dyke' and in a pond in the 'marsh meadow' in 7/53 (PMB and EJP). In 7/54 they were still extant in these areas and also located in the 'Canal' and the *Phragmites* marsh, including the nearby pond (PMB and EJP). The species is afforded Notable B status and has a southern distribution, being absent from Scotland. There are no recent records.

Dytiscus circumflexus Fabricius. Examples located in the ponds in 'Clubley's Field' on 17/8/01 (RM) constitute the fifth record. The others were from the 'Canal' on 18/7/48, the pond near the Humber shore on 21/6/51 and the 'Bomb Crater' in 6/51 and 19/8/70. A widespread and local species, confined to England.

Dytiscus marginalis Linnaeus. Specimens located in the ponds in 'Clubley's Field' on 17/8/01 (RM) added this nationally common species to the Spurn List.

Helophorus fulgidicollis Motschulsky. Previously recorded from an unrecorded area in 6/28 and the saltmarsh at 'Wire Dump' on 30/5/90. The species was recorded from the 'Scrape Field' on 2/11/99, the ponds in 'Clubley's Field' on 17/5/01 and the 'Bomb Crater Pond' and adjacent ditches on 17/5/01 (all MH). A widespread and locally distributed salt marsh species that is less common in the southern half of England.

Sphaeridium scarabaeoides (Linnaeus). A single specimen found at the roadside near the Lighthouse on 4/7/02 (PK) constitutes the fourth record and adds to the known distribution. The previous records were from the 'marsh meadow', the *Phragmites* marsh and the Point.

Hydrobius fuscipes (Linnaeus). During the initial survey the species was recorded from damp areas to the north of the Warren. Specimens from the 'Bomb Crater Pond' on 17/5/01 (MH), the ponds in 'Clubley's Field' on 17/5/01 (MH) and 17/8/01 (RM) constitute the third to fifth recent records, the others being from the 'Bomb Crater Pond' and a ditch near the 'Canal Scrape' on 1/7/93.

Helochares lividus (Forster). Specimens from the ponds in 'Clubley's Field' on 17/5/01 (MH teste MLD) and 17/8/01 (RM) added this species to the Spurn List. The species is afforded Notable B status and is found in freshwater ditches, fens and ponds. Predominantly southern in distribution, although within Yorkshire it is widely distributed

Enochrus bicolor (Fabricius). A single female from the 'Canal Scrape' on 2/11/99 (MH) constitutes the second recent record, the other being from an unrecorded location on 18/8/74. The species had previously been recorded from 'Pallas's Pond', the pond near the Humber shore and the 'Canal' where it was said to be abundant in June, July and August.

Enochrus halophilus (Bedel). Specimens located in the ponds in 'Clubley's Field' on 17/5/01 (MH) and 17/8/01 (RM) constitute the third and fourth records, the others being from an unrecorded area on 10/7/49 and along the edge of 'Canal Scrape' on 19/6/90. This brackish water species, that is very locally distributed in the southern half of England, has been recorded from four Yorkshire localities, all at the mouth of the Humber between Sunk Island (TA31) and Spurn.

Paralister carbonarius (Hoffmann). Specimens located in pitfall traps at the Warren, in the 'Sheep Field' and near the Lighthouse on 9/7/01 added this nationally common species to the Spurn List. Within Yorkshire the species is only known from a further 19 widely scattered localities.

Paralister purpurascens (Herbst). Specimens located in the 'Sheep Field' and near the Lighthouse on 9/7/01 and Chalk Bank on 14/8/01 were the first to be recorded since the initial survey and add to the known distribution. The previous records were from the 'marsh meadow' and the Warren area in 6/51. The species is locally distributed in the British Isles and has only been recorded from a further five Yorkshire localities, all in the east and south of the county.

Ochthebius auriculatus Rey. Two specimens from the ponds in 'Clubley's Field' on 2/11/99 (MH teste MLD) added the species to the Spurn List. The species is afforded Notable B status and is found in shallow muddy pools in salt marshes and saline lagoons. The only other Yorkshire record is from Welwick Saltmarsh (TA31) on 30/10/99.

Agathidium laevigatum Erichson. Several specimens found in pitfall traps between the 'Narrow Neck' and the Lighthouse in 7 and 8/01 add to the known distribution. The previous records were from the Warren on 4/6/50, the sea cliffs at the Warren on 9/6/50 and an unrecorded location on 20/7/63. This locally distributed species is widely scattered in Yorkshire, but rarely recorded.

Choleva jeanneli Britten. A single male from the 'Sheep Field' on 9/7/01 constitutes the second record. The other record was from the Warren area on 23/6/51. Although said to be nationally common, the species has only been recorded from a further 17 Yorkshire localities, most of which are in the south and east of the county.

Sciodrepoides watsoni (Spence). Males located in pitfall traps in the marram at the Warren in 7/01 constitute the second record. The other being from the same locality on 24/7/63.

Catops chrysomeloides (Panzer). Males found in pitfall traps in the marram at the Warren and the 'Narrow Neck' in 7/01 constitute the third and fourth records. The others were from the Main Ridge on 8/6/50 and the Warren on 24/7/63.

Catops grandicollis Erichson. Males found in pitfall traps at the 'Narrow Neck' and Chalk Bank on 9/7/01 added this nationally common species to the Spurn List.

Catops morio (Fabricius). Several males located in pitfall traps between the Warren and Chalk Bank in 7/01 add to the known distribution. The only previous records were from the Warren during the initial survey and on 24/7/63.

Omalium laeviusculum Gyllenhal. Specimens found in pitfall traps in the marram at the Warren on 9/7/01 and 14/8/01 and Chalk Bank on 12/7/01 added this nationally common species to the Spurn List. A coastal species with records from a further six localities along the Yorkshire coast.

Omalium rivulare (Paykull). Several specimens were located in grass cuttings to the north of Chalk Bank on 9/7/01. The previous records were from decaying seaweed along the Humber shore (exact location unknown) during the initial survey and from a decaying grass pile at the Warren on 2/5/93.

Bledius opacus (Block). Four specimens found in pitfall traps at the 'Narrow Neck' in 8/01 constitute the third record. The others were a very small colony in the salt marsh at 'Wire Dump' in 6/47 and three specimens from a dry sandy area (exact location unknown) on 21/7/63. This is a very local species, with scattered records throughout England and southern Scotland. Within Yorkshire the species is only known from five coastal localities.

Stenus cicindeloides (Schaller). Specimens found along the pond edges in 'Clubley's Field' on 17/8/01 (RM det. EJS) added this locally distributed species to the Spurn List.

Stenus crassus (Scopoli). A single male found at the 'Narrow Neck' on 26/12/82 had originally been identified as *S. formicetorum* Mannerheim. The only other record was based on examples located in the *Phragmites* marsh on 9/6/50.

Stenus formicetorum Mannerheim. The single male located at the 'Narrow Neck' on 26/12/82 has now been re-identified as *S. crassus* (Scopoli) (MLD). As there are no further records the species is removed from the Spurn List.

Stenus juno (Paykull). During the initial survey this species was common in the *Phragmites* marsh with occasional specimens being located elsewhere. Examples found along the pond edges in 'Clubley's Field' on 17/8/01 (RM det. EJS) constitute the second recent record. The other specimens were from tide line refuse on the Humber shore at the Warren on 20/11/90.

Stenus ossium Stephens. A single male from a pitfall trap in the marram at the Warren on 13/7/01 is the first record since the initial survey when a single specimen was found on plant roots in the salt marsh at 'Wire Dump' on 15/6/47 and occasional specimens in the marram area on the Humber shore near the Warren (exact location unknown). The species is common in most of Britain, but becomes more local in the north. Within Yorkshire the species is only known from 13 localities, most of which fall in the south and east of the county.

Lathrobium fulvipenne (Gravenhorst). Specimens found in pitfall traps at the 'Narrow Neck' and in the 'Sheep Field' on 9/7/01 add to the known distribution. All previous

records, with the exception of one from an unrecorded location on 12/5/79, had been from the Warren northwards.

Xantholinus jarrigei Coiffait. A single male from grass cuttings at Chalk Bank on 14/8/01 adds to the known distribution. All previous records, with the exception of two from unknown locations, were from the Warren area (including the *Phragmites* marsh). The species is known from a further 12 locations in Yorkshire (all in the east and south of the county).

Xantholinus longiventris Heer. Several specimens from pitfall traps between the Warren and just north of Chalk Bank on 9/7/01 add to the known distribution. All previous records had been from the Warren northwards.

Ocypus aeneocephalus (De Geer). Specimens located to the south of the 'Narrow Neck' on 14/8/01 constitute the third record and add to the known distribution. The previous records, both from the Warren, concerned singles on 14/8/49 and in 7/52.

Tasgius morsitans (Rossi) (=***Ocypus compressus*** Marsham). Specimens found in pitfall traps in the 'Sheep Field' on 9/7/01 constitute the fourth record. The others were from Chalk Bank on 20/6/90, on the Humber shore between the 'Narrow Neck' and 'Black Hut' on 24/6/90 and the Warren on 23/9/94. This locally distributed species is only known from a further nine Yorkshire localities, most of which are in the south and east of the county.

Quedius boops (Gravenhorst). A single male from a pitfall trap in the marram at the Warren on 13/7/01 constitutes the third record. The previous records were from the *Phragmites* marsh on 20/8/49 and an unrecorded area on 14/4/52.

Quedius curtipennis Bernhauer. A single male from grass cuttings at Chalk Bank on 14/8/01 constitutes the fourth record. The previous records were from Chalk Bank in 6/86, 'Clubley's Field' on 23/6/90 and in a grass pile outside Warren Cottage on 21/9/94.

Quedius fuliginosus (Gravenhorst). Males located in pitfall traps in the marram at the Warren on 9/7/01 provide the second authentic record, the other being from the same locality on 2/10/83. Confusion with *Q. curtipennis* Bernhauer makes the two records from the initial survey unreliable without voucher specimens.

Quedius humeralis Stephens. During the initial survey this species was recorded from the Warren, the *Phragmites* marsh and the salt marsh at 'Wire Dump'. Examples found along the pond edges in 'Clubley's Field' on 5/6/01 (RM det. EJS) constitute the second recent record, the previous one being a few examples found along the 'Canal' edge on 21/9/86.

Quedius nitipennis (Stephens). Males located in pitfall traps at the 'Narrow Neck' on 10/7/01 and Chalk Bank on 12/7/01 added this nationally common species to the Spurn List. Although said to be widespread and common nationally, the species has only been recorded from a further 23 widely scattered Yorkshire localities.

Quedius picipes (Mannerheim). Specimens from pitfall traps near the Lighthouse on 9/7/01 constitute the third record. The previous records were from Chalk Bank in 6/86 and the Humber shore near the Point on 29/6/91. Although widely distributed and common nationally, the species has only been recorded from a further 23 Yorkshire localities (most of which fall in the south and east of the county).

Quedius semiaeneus (Stephens). A single male from a pitfall trap near the Lighthouse on 9/7/01 constitutes the third record and adds to the known distribution. The previous records were from the Warren on 15/8/49 and the salt marsh at 'Wire Dump' on 10/6/50. Although common nationally, the species is only known from a further 16 Yorkshire localities, most of which are in the eastern half of the county.

Quedius semiobscurus (Marsham). During the initial survey this species was said to be not uncommon over most of the area in debris of various kinds and on plant roots. Specimens from Chalk Bank on 5/6/01 and 17/8/01 (RM det. EJS) constitute the second and third recent records, the other being a single at the Warren on 21/9/94.

Mycetoporus piceolus Rey. A single from a pitfall trap in the marram at the Warren on 14/8/01 was the first record since single examples were found at the Warren on 17/6/51 and a wet place on the sea cliffs (exact location unknown) on 17/6/51 and 12/7/52. These are the only Yorkshire records of this species which is afforded Notable B status.

Bolitobius cingulatus Mannerheim. A single from a pitfall trap to the north of Chalk Bank on 9/7/01 added this locally distributed species to the Spurn List.

Sepedophilus immaculatus (Stephens). Specimens from pitfall traps at the 'Narrow Neck', Chalk Bank, the 'Sheep Field' and near the Lighthouse on 9/7/01 were the first records since the initial survey and add to the known distribution. The previous records were of single examples on plant roots at the Warren on 8/6/50 and 20/6/51. Within Yorkshire the species is only known from a further 11 locations, all in the east and south of the county.

Tachyporus pallidus Sharp. A single from a pitfall trap at the 'Narrow Neck' on 9/7/01 constitutes the third record and adds to the known distribution. All previous records had been from the Warren northwards.

Lamprinodes saginatus (Gravenhorst). Examples from pitfall traps in the marram at the Warren on 9/7/01 and the 'Narrow Neck' on 9/7/01 and 14/8/01 constitute the only records since a single was found on the sea cliffs (exact location unknown) on 17/6/51. The species is afforded Notable A status. Within Yorkshire the species is known from four other locations, all in the south and east of the county.

Tachinus marginellus (Fabricius). Specimens from pitfall traps at the 'Narrow Neck' on 9/7/01 and grass cuttings at Chalk Bank on 14/8/01 add to the known distribution. All previous records had been from the Warren northwards.

Tachinus signatus Gravenhorst. Several specimens located at a number of localities between the Warren and the Lighthouse in 7 and 8/01 add to the known distribution. All previous records, with the exception of one from the Point, had been from the Warren northwards.

Tachinus pallipes (Gravenhorst). Examples from pitfall traps in the marram at the Warren on 14/8/01 added this nationally common species to the Spurn List.

Ischnopoda (=***Tachyusa***) ***atra*** (Gravenhorst). Specimens located along the pond edges in 'Clubley's Field' on 17/8/01 (RM det. EJS) added this locally distributed species to the Spurn List.

Dinaraea angustula (Gyllenhal). Specimens in pitfall traps near the Lighthouse on 9/7/01 added this locally distributed species to the Spurn List.

Liogluta longiuscula (Gravenhorst). Examples in grass cuttings at Chalk Bank on 12/7/01 added this species to the Spurn List. Although widely distributed in Yorkshire, the species is rarely encountered.

Mocyta (=***Atheta***) ***orbata*** (Erichson). Specimens found at the 'Narrow Neck' on 17/8/01 (RM det. EJS) constitute the first record since a few examples were located in the 'Canal Zone' and at the roots of marram along the Humber foreshore near the Warren (exact location unknown) during the initial survey.

Atheta aeneicollis (Sharp) (=***pertyi*** (Heer)). Specimens located in grass cuttings at Chalk Bank on 12/7/01 and in pitfall traps at the 'Narrow Neck' on 14/8/01 constitute the second and third records, the other being a single from a wet place on the sea cliffs (exact location unknown) on 8/6/50.

Atheta intermedia (Thomson). Examples found in grass cuttings at Chalk Bank on 12/7/01 added this to the Spurn List. This is only the fourth record for the county and the first for VC61, the previous being from Malham (SD86) in 1954, Elland Park Wood (SE12) in 1985 and Swinden Plantation (SE10) in 1988.

Oxypoda exoleta Erichson. Past confusion with other members of the genus renders the records in 1950, 1951 and 1952 unreliable without voucher specimens. As no specimens have been located, the species has been deleted from the Spurn List.

Oxypoda haemorrhoa (Mannerheim). Examples found in grass cuttings at Chalk Bank on 14/8/01 add to the known distribution. The previous records were from a straw heap in the 'marsh meadow' during the initial survey and from old straw in 'Clubley's Field' on 23/6/90.

Oxypoda brevicornis (Stephens) (=***umbrata*** Gyllenhal). Specimens from Chalk Bank on 12/7/01 and 14/8/01 constitute the fourth and fifth records and add to the known distribution. The other records were from reed debris in the *Phragmites* marsh on 23/7/48,

a wet place on the sea cliffs (exact location unknown) on 12/7/52 and the Point on 23/7/63.

Brachygluta fossulata (Reichenbach). Specimens located in pitfall traps in marram at the Warren on 13/7/01 added this nationally common species to the Spurn List.

Geotrupes spiniger (Marsham). Singles found at the Point and near the Lighthouse on 31/7/98 (PK) constitute the fourth and fifth records and add to the known distribution. The others were from the Warren on 25/9/93, near the 'Canal Scrape' hide on 24/7/94 and south of the Warren on 15/9/96.

Geotrupes stercorarius (Linnaeus). A single on the road at the Warren on 24/9/98 constitutes the fifth record, the others being from the Point on 5/6/50, the *Phragmites* marsh on 11/6/50, an unrecorded area in 7/63 and the Warren on 15/9/93.

Aphodius contaminatus (Herbst). A single encountered in the 'Canal Zone' on 22/9/97 constitutes the second record, the other being a single found inside Warren Cottage on 21/9/94.

Aphodius plagiatus (Linnaeus). A single in a pitfall trap at the 'Narrow Neck' on 9/7/01 added this species to the Spurn List. This 'dung beetle' lives in decaying seaweed and other tidal litter in saltmarshes, dunes and grazing levels. The species is afforded Notable B status and is confined to the coast of southern Britain, Yorkshire being its northern limit. The only other Yorkshire records are from the saltings to the north of the Observatory recording area in 1950 and 1951.

Adrastus pallens (Fabricius). A single from a pitfall trap at the 'Narrow Neck' on 9/7/01 provides the second record and adds to the known distribution. The previous record was of specimens at the Warren on 12/7/52.

Agriotes lineatus (Linnaeus). Specimens from the 'Narrow Neck', the 'Sheep Field' and near the Lighthouse on 9/7/01 add to the known distribution. All previous records had been from the Warren northwards.

Agriotes sputator (Linnaeus). Examples from pitfall traps in the marram at the Warren on 13/7/01 constitute the fourth record. The previous records were from the Warren on 4/6/50, the 'Canal Zone' on 2/5/93 and near the 'Canal Scrape' on 5/5/93.

Cantharis nigra (De Geer). Specimens at the Warren on 9 and 13/7/01 constitute the fifth and sixth records. The previous records were from the 'Canal Zone' on 18 and 21/7/48, the Humber shore between the reserve entrance and the 'Crown and Anchor' on 19/6/90 and near 'Pallas's Pond' on 1/7/93.

Cryptophagus setulosus (Sturm). A single male found in a pitfall trap to the north of the 'Sheep Field' on 9/7/01 constitutes the third record and adds to the known distribution. The other records were from the nest of the bee *Bombus agrorum* at the Warren on 8/6/50 and in a pitfall trap in a rabbit burrow (exact location unknown) on 23/7/63.

Atomaria rubella Heer. Examples located near the Lighthouse on 29/6/91 (documented as *A. berolinensis* Kraatz in Denton 1997) were incorrectly stated to be the first and only record for the peninsula. As *berolinensis* is a synonym of *rubella* the record should have been attributed to that species. The entry should have stated that this was the second record, the other being from an unrecorded location on 10/6/50. Since this time the species has been found in recently cut vegetation outside Warren Cottage on 3/5/93 (MLD teste CJ) and under decaying rhubarb leaves at the side of the Annexe on 16/9/96 (MLD det. CJ).

Atomaria lewisi Reitter. Examples from grass cuttings at Chalk Bank on 12/7/01 add to the known distribution. This introduced species had previously been recorded from the 'Narrow Neck' northwards.

Calvia quattuordecimguttata (Linnaeus). Singles in the light trap at the Warren on 1 and 7/7/01 (BRS det. MLD) added this nationally common species to the Spurn List.

Crypticus quisquilius (Linnaeus). During the initial survey this species was located in most areas along the Peninsula, where it was said to be abundant in June, common in July, but scarce in August. Specimens located at the Warren on 5/6/01 (RM det. EJS) constitute the fifth recent record, the others being from the Warren, the Humber shore at the 'Narrow Neck', the Humber shore between the 'Narrow Neck' and 'Black Hut', and on open ground to the north of the Lighthouse.

Pyrochroa serraticornis (Scopoli). Two examples flying near the Warren on 18/6/00 (FEK teste MLD) constitute the third record. This saproxylic species was originally recorded from an old ash trunk that had been washed up on the Humber shore (exact location unknown) in 6/50; a single was seen at the Warren on 31/5/92.

Anaspis maculata Fourcroy. Specimens beaten from *Crataegus monogyna* at Chalk Bank on 10/7/01 and near the Lighthouse on 12/7/01 add to the known distribution. All previous records were from the Warren and 'Clubley's Field'.

Notoxus monoceros (Linnaeus). Encountered abundantly along the Humber foreshore and seashore (exact locations unknown) during the summer months of the initial survey. Specimens located at the Warren on 5/6/01 and 17/8/01 (RM det. EJS) constitute the fifth and sixth recent records, the others being from an unrecorded area on the Humber foreshore, Chalk Bank, the sea shore near the Point and to the north of the Lighthouse.

Longitarsus jacobaeae (Waterhouse). Examples from Chalk Bank on 14/8/01 add to the known distribution. The previous records, with the exception of two from unrecorded locations, were from the Main Ridge on 13/8/49, the *Phragmites* marsh on 15/8/49 and 'Clubley's Field' on 19/6/90.

Psylliodes marcida (Illiger). Specimens found on *Cakile maritima* on the Humber shore at the Warren in 8/97 (WRD teste MLD) were the first to be recorded since being found at the Point on 22/7/63. During the initial survey the species was said to be present in June, common in July, but rare in August.

Omphalapion hookeri (Kirby). Specimens located on *Tripleurospermum* in the saltmarsh at the Warren in 8/97 (WRD teste MLD) constitute the fourth record. The previous records were from the 'marsh meadow' on 3/6/50, the Warren on 21/7/63 and an unrecorded area on 15/7/63.

Ceratapion gibbirostre (Gyllenhal). A single specimen from the 'Blue Bell' on 5/11/83 (documented as *Apion carduorum* Kirby in Denton 1995) has been re-identified as this species (MLD). A better understanding of the identification characteristics (Morris 1990) has revealed that the true *carduorum* has a southern distribution. In light of this, the records from the 'marsh meadow' on 17/6/47 and 3/6/50 and the Warren on 5 and 10/6/50 should be viewed with caution without voucher specimens; although *C. gibbirostre* can be added to the Spurn List, *C. carduorum* should be removed.

Diplapion confluens (Kirby). Specimens encountered at the northern end of the 'Canal Zone' in 8/97 (WRD teste MLD) provide only the second record, the previous being from an unrecorded area on 15/7/89. These records are an extension of the known distribution, as Morris (1990), indicates that the species is locally common in England (normally on the coast) northwards to west Norfolk on the east coast but extending further north on the west coast (to south-west Scotland).

Holotrichapion ononis (Kirby). Specimens from near the Lighthouse on 10/7/01 and to the north of Chalk Bank on 12/7/01 add to the known distribution. All previous records were from the salt marsh at 'Wire Dump' and from the Warren northwards. This locally distributed species is known from a small number of widely scattered localities in Yorkshire.

Otiorhynchus singularis (Linnaeus). Examples from pitfall traps to the south of the 'Narrow Neck' and Chalk Bank on 14/8/01 add to the known distribution. All previous records were from the Warren and 'Clubley's Field'.

Otiorhynchus sulcatus (Fabricius). A single located in the 'Canal Zone' on 23/9/98 constitutes the second record, the other being from the Humber shore at the Warren on 18/6/90.

Phyllobius glaucus (Scopoli). Specimens located at the 'Narrow Neck' on 9/7/01 constitute the second record, the previous being specimens found on *Lotus corniculatus* at the Warren on 11/6/50.

Hypera nigrirostris (Fabricius). Several dozen specimens were found in pitfall traps between the 'Narrow Neck' and the Lighthouse on 7 and 8/01. The previous records were from the salt marsh at 'Wire Dump' on 16/6/47, the *Phragmites* marsh on 12/7/65 and

unrecorded locations on 20/7/63 and 18/8/66.

Hypera postica (Gyllenhal). A single on the Annexe wall on 22/9/98 constitutes the second record, the other being from the Warren on 16/8/49.

Euophryum confine (Broun). Specimens under drift-wood at the 'Narrow Neck' on 9/7/01 and 14/8/01 constitute the second and third records and add to the known distribution. The previous record of this introduced species was based on a few examples found under drift-wood at Chalk Bank on 23/6/90.

Ceutorhynchus quadridens (Panzer). Examples from pond side vegetation in 'Clubley's Field' on 17/8/01 (RM det. EJS) constitute the first record since specimens were found in the 'marsh meadow' on 14/8/49.

Tychius picirostris (Fabricius). Examples from an unrecorded location in 1946 were incorrectly stated to be the first and only record for the Peninsula (Denton 1997). Two further records can be found in Denton (1995), under *Miccotrogus picirostris*. The entry should have stated that the 1946 record was the first documented occurrence on the Peninsula, the others being from the 'marsh meadow' on 3/6/50 and the Warren on 10/6/50 (on *Trifolium repens*). Specimens from the Warren on 5/6/01 (RM det. EJS) provide the only recent record.

Acknowledgements

Bob Merritt is thanked, not only for supplying records, but also for drawing my attention to the paper by Butler and Popham which added two water beetle species to the Spurn List. Most of the 2001 records of terrestrial species stem from a survey undertaken for Associated British Ports and Claire Brown kindly explained the legalities regarding their publication.

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RECORDER'S EIGHTH REPORT OF THE ACULEATE HYMENOPTERA IN WATSONIAN YORKSHIRE

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Since my last report (Archer 2001) four new aculeate species have been found in Watsonian Yorkshire. In the following account, recorders are identified by the initials: M.E. Archer (MEA), F. Botherill (FB), D.S. Bower (DSB), A. Brackenbury (AB), J.T. Burn (JTB), J.D. Coldwell (JDC), C. Collingwood (CC), R. Crossley (RC), W.A. Ely (WAE), R. Glynn (RG), A. Godfrey (AG), C. Howes (CH), S.J. Hayhow (SJH), P. Kendall (PK), I. Nethercoats (IN), D. Parkinson (DP), S. Russell (SR), S. Saxton (SS), R. Smith (RS), R.M. Sunter (RMS) and D. Whiteley (DW).

The new species are:

Tiphia minuta Vander Linden, Manvers (SE40) JDC, June 2001; Armthorpe (SE60) JTB, June 2001. *Agenioideus cinctellus* (Spinola), Pot Hill, Sandall Beat Wood (SE60) JTB,

Aug. 2000. *Crossocerus distinguendus* (Morawitz), York Cemetery (SE65) MEA, July 2000, July 2001, July 2002; Burton Leonard Lime Quarries (SE36) MEA, Aug. 2002; Sand Hutton (SE65) MEA, June, July 2003. *Anthidium manicatum* (Linn.), Sheffield (SK38) RS, July 2001, DW, July 2001; Clifton Backies, York (SE55) MEA, June 2003; Keighley (SE04) SS, June 2003.

OTHER IMPORTANT RECORDS ARE:

Pseudomalus violaceus (Scopoli), Sheffield (SK38) RS, 2000, Aug. 2001; Potteric Carr (SE50) AB, Aug. 2001; St. Nicholas Fields, York (SE65) MEA, June 2003.

Chrysura radians (Harris), Dike Hagg (SK59) WAE, June 1992.

Formicoxenus nitidulus (Nylander), Near Hebden Bridge (SD92) CC, recent; Harwood Dale (SE99) CC, recent.

Myrmica lobicornis Nylander, Listerdale (SK49) WAE, July 1982; Grange Park (SK39) WAE, Sept. 1991; Nor Wood (SK59) SJH, June 1986.

M. sabuleti Meinert, Pieces Bank (SK59), WAE, Sept. 1982; Anston Stones Wood (SK58) WAE, June 1987; Shipley Station Butterfly Reserve (SE13) DP, July 2003.

Priocnemis cordivalvata Haupt, Cornelian Bay (TA08) MEA, July 2000.

Caliadurgus fasciatellus (Spinola), Allerthorpe Common (SE74) RC, Aug. 1999.

Anoplius infuscatus (Vander Linden), Blaxton Common (SE60) PK, July 2000.

Vespa crabro Linn., Hatfield Woodhouse (SE60), via CH, summer 1999; worker, Kilnhurst Ings (SK49) WAE, June 2000; workers, south-east of Rotherham (SK58) DSB, June 2000; workers at sap flow, Brayton Barff (SE53) AG, July 2000; Fosterhouses (SE61) via CH, Nov. 2000; Howden (SE73) CH, 2002; Rotherham (SK49) FB, May 2002; nest that failed, Sand Hutton (SE65) MEA, July 2002; Doncaster (SE50) RG, Oct. 2002; Burton Bushes, Beverley (TA03) IN, Aug.-Sept. 2003; male, Holme-on-Spalding Moor (SE83) SR, Sept. 2003.

Dolichovespula saxonica (Fab.) Sheffield (SK38) RS, Aug. 2001; Sand Hutton (SE65) MEA, July 2002.

Crossocerus leucostomus (Linn.), Pollington Quarry (SE62) MEA, July 2002.

Spilomena curruca (Dahlbom) (= *differens*), Sheffield (SK38) RS, Sept. 2000.

Cerceris arenaria (Linn.), Pollington Quarry (SE62) MEA, July 2001.

Philanthus triangulum (Fab.), Pot Hill, Sandall Beat Wood (SE60) JTB, Aug. 2000; Southern Washlands (SE32) RMS, Aug. 2000; Pollington Quarry (SE62) MEA, Aug. Sept. 2000.

Sphecodes ferruginatus von Hagens, Brimham Rocks (SE26) MEA, Aug. 2001.

S. reticulatus Thomson, Pollington Quarry (SE62) MEA, Aug. Sept. 2000, Sept. 2002.

Coelioxys rufescens Lepeletier & Serville, Cornelian Bay (TA08) MEA, July 2000.

Nomada flava Panzer, female, Potteric Carr (SE50) WAE, May 2002.

Melecta albifrons (Forster), Helmsley Castle (SE68) MEA, April 2001; Reighton Cliffs (TA17) MEA, June 2003.

Bombus muscorum (Linn.), Branston Sands (TA15) MEA, May 2003.

B. rupestris (Fab.), Brayton Barff (SE53) MEA, July Aug. 2001.

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STATUS OF EURASIAN WIGEON IN THE YORKSHIRE DALES NATIONAL PARK IN 2003 AND A REVIEW OF RECENT HISTORICAL BREEDING RECORDS

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Introduction

Eurasian Wigeons, *Anas penelope*, hereafter referred to as Wigeon(s) have been known to breed at a number of moorland tarns and other water bodies in the Yorkshire Dales National Park (Mather 1986). Recent reports have suggested that there may be as many as 30+ pairs of Wigeon attempting to nest in the National Park each year, a total that would represent an important component of the national breeding population of between 300 and 500 pairs (Stone *et al.* 1997).

In the Local Biodiversity Action Plan for the National Park, *Nature in the Dales*, the Wigeon was categorised as a Priority Species for conservation due to the potential national importance of local breeding populations along with indications that this population was declining and evidence of recent poor breeding success at the main breeding site. A Species Action Plan (SAP) was produced (Yorkshire Dales National Park Authority 2000) that included action to determine the current distribution and status of breeding Wigeons in the National Park in order that any future population changes could be effectively monitored.

The implementation of the Countryside and Rights of Way Act (CRoW) will mean that there will be a statutory right of access to all mountain, moor, heath and downland in England although some areas may be subject to restrictions in relation to land management, safety or nature conservation reasons. Currently, 4% of the National Park has some form of open access, but this will increase to 63% under the new legislation and will include a number of areas where Wigeons have been known to breed. Thus, up-to-date information on breeding was also required for the nature conservation review being undertaken prior to the implementation of Open Access. In order to fulfil both these requirements, English Nature funding enabled a survey to be carried out to determine the current distribution and status of breeding Wigeons in the Yorkshire Dales National Park in 2003.

Methods

The historical breeding records for the area were derived from a number of surveys using different methodologies. Breeding birds were located at a number of sites during the Moorland Bird Survey (MBS) of the National Park carried out between 1992 and 1995. Although this survey was primarily intended to detect breeding waders, a number of other moorland bird species, including Wigeons, was recorded. The moorlands of the National Park were divided into five areas and where access permissions had been granted, survey work was carried out. The MBS followed the standard methodology for surveying breeding waders on moorland with two visits to each 1 km square, one in April/May and the other May/June. In the course of the survey, a number of moorland tarns and other areas of potentially suitable Wigeon breeding habitat were visited.

Yorkshire Water commissioned a specific survey in 1995 at Site 8, when 36 visits were

made between 26th February and 30th September using the British Trust for Ornithology Common Bird Census methodology (Barker 1995). A number of visits have also been made to this site by members of the Yorkshire Dales Upland Bird Study Group between 1996 and 2002 to record the number of Wigeons present during the breeding season.

Using the information derived from the MBS, two sites in VC64 and seven sites in VC65 were identified as known, or potentially suitable, breeding sites and were surveyed in 2003. Once access permissions had been agreed, three visits were made to each site: in early to mid-May, in mid-May to mid-June, and a final visit between mid-June and mid-July. Although the majority of visits were carried out in the early morning with survey work preferably completed by 10.00 a.m., the large areas, and distances that had to be covered, meant that this was not always possible. In order to avoid disturbance to a number of other breeding bird species at each site, all areas of potentially suitable habitat were viewed from a convenient vantage point apart from Sites 3 and 6 where the topography made this impossible. A number of additional visits were made to Site 8 after mid-July to try and determine the number of fledged young.

The maximum number of males, females or pairs of Wigeons recorded from each site were taken to represent the number of breeding pairs (Gilbert *et al.* 1998). The number of any young birds was also recorded. A number of access related comments were also recorded at each site but are not detailed in this report.

In order to determine the recent historical status of Wigeons in the National Park, a review of the Yorkshire Naturalists' Union Annual Bird Reports (1972 to 1996) was undertaken to find any additional records of breeding within the National Park.

Results

2003 Survey Results

Wigeons were found at seven of the nine sites surveyed with confirmed breeding at four, probable breeding at one and possible breeding at two. Based on Gilbert *et al.* (1998), a minimum of 16 pairs was present in the area with at least 29 ducklings hatched. Fully feathered young were recorded only from Site 8 where 15 young were present in late July. The number of breeding pairs and the number of young located at each site in 2003 is shown in Table 1.

TABLE 1.

The breeding success of Eurasian Wigeons at nine sites in the Yorkshire Dales National Park surveyed in 2003. (Key: Γ = male, ΓΓ = males, E = female, EE = females)

	No. of adults and no. of young Wigeons recorded on:			Max. no. of pairs	Min. no. of young hatched
Site	**1st visit**	**2nd visit**	**3rd Visit**		
1.	0	1Γ	1E	1	None recorded
2.	1Γ	0	2 EE	2	At least 2
3.	1Γ	1Γ	1E + 2 young	1	2
4.	1Γ, 1E	0	1E + 6 young	1	6
5.	2 ΓΓ	0	1 E	2	Not known[1]
6.	0	2 ΓΓ	0	2	None recorded
7.	0	0	0	0	None recorded
8.	5 ΓΓ	3EE + 9 chicks	2 ΓΓ, 7EE + 19 young	7	19
9.	0	0	0	0	0

[1] The female stayed on the water near to the rushes and close to the observer, 'growling' constantly, suggesting that young birds were present.

Historical breeding information

The records of breeding detailed in the Yorkshire Naturalists' Union Annual Bird Reports (1972 and 1996) and taken from the MBS are shown in Table 2.

TABLE 2.
The number of adult and young Eurasian Wigeons recorded during the breeding season at sites in the Yorkshire Dales National Park between 1972 and 1997 (excluding data from the main breeding site).

Year	Site No.	No. of adult and young Wigeons recorded	Source of data
1986	Five	One pair + one young	Curtis 1986
1987	Five	Two females + young	Curtis 1987
1990	One	One pair	Curtis 1990
1990	Five	Two pairs	Curtis 1990
1992	Two	Three pairs	Curtis 1992
1992	Three	Three pairs	MBS, unpublished
1992	Four	One or two pairs	MBS, unpublished
1993	Four	Five pairs	MBS, unpublished
1993	Five	Ten pairs	MBS, unpublished
1993	Additional site	Female accidentally flushed off a nest of eight eggs	MBS, unpublished
1995	Additional site	Male present on 11th May, but not seen subsequently	MBS, unpublished

At the main breeding locality (Site 8), Wigeons were first recorded breeding in 1955 when a pair was observed in May and a female with a single duckling was recorded in June (Mather 1986). There were no further reports until 1973, when a pair with four ducklings was present and two pairs, without any young, were recorded in 1974 (Mather 1986). The breeding data for Site 8, derived from both anecdotal records and systematic survey work, has been collated between 1973 and 2003 and is shown in Table 3. Since at least 1985 there have been between five and 14 pairs of Wigeons attempting to nest annually at this site which has consistently supported over 1% of the UK breeding population and is therefore classed as a nationally important breeding site for this species (Nature Conservancy Council 1989).

Discussion

The visits for the 2003 survey were carried out later than the dates suggested by Gilbert *et al.* (1998) due to a number of technicalities that regrettably arose during preparatory work which meant that any surveying would not have been possible until mid-April at the earliest. There were also concerns about separating non-breeding and breeding birds, as previous observations at Site 8 have shown that flocks of wintering Wigeons are still present up until at least mid-April and regularly until the end of the month. The authors considered that following the recommended generic survey dates for Wigeons (Gilbert *et al.* 1998) would have made it difficult to distinguish accurately between late wintering and breeding birds and that counts in early to mid-April could result in an over-estimation of the breeding population at Site 8. It is not known if wintering birds use any of the other sites but it was considered that similar problems might have been encountered. As a result, the visits for the 2003 National Park Survey were carried out later than the dates recommended in Gilbert *et al.* (1998). It is acknowledged that this may have resulted in an under-estimation of the actual number of nesting attempts. The authors therefore consider

TABLE 3.
Breeding records of Eurasian Wigeons at the main breeding location (Site 8) in the Yorkshire Dales National Park 1973 to 2003.

Year	No. of breeding pairs	No. of young	Source
1973	1	4	Mather 1986
1974	2	0	Mather 1986
1975	1 female	5	Mather 1986
1975	3	8	Barker 1995
	1 female	5	Mather 1975
1976	1 Female	4	Mather 1986
1977	No reports		
1978	1 female	8	Mather 1978
1979	No reports		Mather 1979
1980	No reports		Dale 1980
1981	No reports		Dale 1981
1982	1 female	2	Dale 1982
1983	No records		Dale 1983
1984	11 adults	5 on 26/7	Dale 1984
1985	9 adults	28 on 16/6	Dale & Curtis 1985
1986		27 on 25/6 with a total of 55 adults and immatures on 5/8	Curtis 1986
1987		7 broods totalling 31 young on 24/6	Curtis 1987
1988	No reports		Curtis 1988
1989	No reports	48 fledged young	Curtis 1989 Barker 1995
1990	No reports 5-13	21 fledged young	Curtis 1990 (Barker 1995 unpubl.)
1991	No reports		Curtis 1991
1992		Two broods of 4 and 8	Curtis 1992
1993		Four broods of 4,8,3,3,	Curtis 1993
1994	9-10	Broods of 1, 2, 4, and 6 in June	MBS, Unpublished
1995	One female 9-10	6 young 45 young hatched, 6 fledged	Curtis 1995 Barker 1995
1996	12-13	4 broods fledged 15 young 58 young hatched, 15 fledged	Curtis 1996 (Barker 1995 unpubl.)
1997	No reports 11-14	60 young hatched, 29 fledged	Degnan & Dobbs 1997. (Barker 1995 unpubl.)
1998	11-12	51 hatched, 5 fledged	(Barker 1995 unpubl.)
1999	10-12	37 hatched, 8 fledged	(Barker 1995 unpubl.)
2000	9-11	5 fledged	Barker 1995
2002	No data		
2003	Min. 7 females	Minimum 19 hatched, 15 fledged	2003 Survey

that the quoted figures for the number of breeding pairs should be taken as the minimum that attempted to breed at each site.

Although the final survey visit (carried out between mid-June and mid-July) was up to a month later than recommended in Gilbert *et al.* (1998), it was still too early to determine the number of fledged young. The straightforward access at Site 8 enabled a number of additional visits to be made to try and determine this. On several visits in late July there was a total of 15 fully-feathered young, and although at least three of these were incapable of flight, it is possible that the others were older and fully fledged. The response of the majority of the Wigeons and Mallards *Anas platyrhynchos* to the fieldworkers (often whilst at considerable distance) was to walk, rather than fly, to the water and then swim away; it was not possible therefore to determine the number of young capable of flight. During these later visits the distance involved also meant that it was not possible to accurately distinguish between some adult females and juvenile birds.

There is insufficient information to determine accurately any population trends in the National Park. However, the limited data do suggest a slight population decline with the current number of breeding Wigeons not as high as previous population estimates have suggested.

More data are available for the core breeding sites but the different methodologies used makes accurate comparisons difficult. Since Mather (1986) did not refer to any breeding records between 1955 and 1972, the Yorkshire Naturalists' Union Annual Bird Reports were reviewed from 1972 onwards to determine any such records. At the core breeding site, published records show that between one and three breeding pairs were present from at least 1972 until 1976 (Mather 1986) when construction work to increase the size of the reservoir began. This work was not completed until 1984 (Barker 1995) during which time there were only two breeding records with single females recorded in 1978 and 1982.

Upon completion of the construction work, the number of breeding pairs increased, with between five and 14 pairs each year up until at least 2000. Although the number of breeding females (7) located in 2003 is at the lower end of this population figure, this may be as a result of birds or pairs missed in April rather than a genuine decline. There has been considerable variation in the breeding success at this site between 1984 and 2003 and although a number of reasons have been suggested, further research is required to determine the cause of low productivity in some years.

Summary

The collation of anecdotal records of breeding Eurasian Wigeon, *Anas penelope,* and data derived from the Moorland Bird Survey and other specific Wigeon surveys have indicated that in the early 1990s at least, there may have been 30+ breeding pairs in the Yorkshire Dales National Park. A baseline survey of nine known or potential breeding sites in the National Park was carried out in 2003. A total of 16 pairs was located at seven sites with confirmed breeding occurring at four, probable breeding at one and possible breeding at a further two. A minimum of 29 ducklings was recorded during the survey period with 15 fully feathered (and possibly fledged) young located during additional visits to one site.

Away from the core site there is insufficient data to determine any recent population trends for the National Park. It would appear that the breeding population at the core site (Site 8) is fairly stable but for unknown reasons the breeding success is very variable. This site has consistently supported over 1% of the UK breeding population and is therefore recognised as of national importance.

Acknowledgements

This survey would not have been possible without funding from English Nature. The authors would like to thank the landowners for granting access permissions and the gamekeepers who helped to arrange access to a number of the sites. Historical survey data have been provided by a number of past and present members of the Yorkshire Dales Upland Bird Study Group, notably David Barker with an additional report kindly supplied

by Miles Foulger of Yorkshire Water Ltd. We are also grateful to John R. Mather for his most useful comments in the preparation of this paper.

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RECORDS OF MOLE-CRICKETS *GRYLLOTALPA* (ORTHOPTERA: GRYLLOTALPIDAE) IN YORKSHIRE

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Introduction

The Mole-cricket *Gryllotalpa gryllotalpa* (L.) is a difficult insect to understand in a Yorkshire context, with little evidence of any kind. It is one of nine species of native Orthoptera for which Yorkshire is a northern frontier to the east of the Pennines (Haes & Harding 1997); hence, details of its occurrence in the county are of some significance. As it is also the sole member of the Orthoptera listed in *A Biodiversity Audit of Yorkshire & the Humber* (Selman *et al.* 1999), it is timely to summarise known Yorkshire *Gryllotalpa* claims, including reference to a second species in the county.

The Mole-cricket

The Mole-cricket was once widespread in parts of England and Wales, and was also known from one locality in Scotland. It was essentially a wetland creature, "confined in the natural state to water meadows and wet heathlands over both heavy and light soils" (Marshall & Haes 1988). Mole-crickets were sufficiently familiar to have local names, and although subterranean in habit, attention was often directed to them by the males' distinctive stridulation at their burrow entrances; also, the insect's burrowing could cause horticultural damage, with Gilbert White in the 1770s noting that they "often infest gardens by the side of canals", being "unwelcome guests to the gardener" (Allen 1989).

Eventually, habitat destruction and perhaps other forces reduced the status of the species to that of an endangered component of the British fauna. The scattered, isolated records typical of the last 60 years have tended to be regarded as involving casuals, but may at least partially represent genuinely native survivors (Haes & Harding 1997). Nevertheless, the potential for accidental introduction has been clearly demonstrated, especially as the species ranges over Europe, North Africa and western Asia.

YORKSHIRE *GRYLLOTALPA* DATA

1. The rarity of the Mole-cricket in Yorkshire is evinced by its failure to appear in G. T. Porritt's list of the county's orthopteroid insects (Porritt 1907). His list was largely a collation of incidental records, and Mole-crickets can be elusive insects. Nevertheless, it is a little surprising that he was unable to quote a single record or reference from the entire 18th and 19th centuries.
2. From the Doncaster district, an allusion to the Mole-cricket is contained in Edwin Lankester's *An Account of Askern* (Lankester 1842). In writing of the village and its vicinity, Lankester observed that "[t]he Cock-roach may be infrequently seen over the floors of kitchens and cottages, in this district, and the Mole-cricket's song is often heard on summer evenings". Although he was not an entomologist, Lankester's evidence can be taken as rigorous and trustworthy (English 1990). His comment was the justification for the assertion by Limbert (1999) that the Mole-cricket was a former denizen of Yorkshire.
3. To the east of Askern lies Thorne Moors. For many years, the leading naturalist here was Wm Bunting (Caufield 1991, Skidmore 1996), and he found a Mole-cricket on Thorne Moors sometime during the 1950s (Limbert 2003). This occurrence is mapped in Haes and Harding (1997).
4. Stainforth (1905) documented and drew a *Gryllotalpa* "found amongst some radishes [*Raphanus*] in the city [of Hull], and brought recently to the Hull Museum". This was published as "Gryllotalpa vulgaris" (= *G. gryllotalpa*). The vagueness of the wording is unfortunate, as it is not made clear whether the specimen was captured amongst harvested produce or obtained in a vegetable patch. Because of this uncertainty, and Hull's position as a port, this insect's appearance may have been merely fortuitous. Further, it cannot be claimed with reasonable certainty to have been *G. gryllotalpa*. Regrettably, the collection in the Hull & East Riding Museum does not hold this specimen, so it is no longer available for examination; also, the exact date of the occurrence is not certain, as the reference seen had been reprinted from the *Eastern Morning News*. Despite this, it may be provisionally dated to the earlier months of 1905.
5. A single Mole-cricket was encountered in 1965 at or near Grenoside, Sheffield. This record is included by the Orthoptera Recording Scheme for Britain and Ireland as *G. gryllotalpa* (Haes 1983), and is mapped in Marshall and Haes (1988) and Haes and Harding (1997).
6. Another single *Gryllotalpa* was found dead (but still "slightly pliable") in a shop in Coney Street, York, on 23 November 1999. There was no obvious vector for the occurrence of the specimen in the shop. It was passed to Dr G. S. Oxford, who forwarded the specimen to Doncaster Museum & Art Gallery, where it is now kept. It was subsequently identified for the ORSBI as the African Mole-cricket *G. africana* Beauvois (Widgery 2001), although the latter source erroneously documented it as from Huntington, to the north of York. Its true provenance lay within the city, at map reference SE602518. Interestingly, *G. africana* does not appear in the British and Irish checklist published in Marshall and Haes (1988).

GRYLLOTALPA IN YORKSHIRE

The Mole-cricket *Gryllotalpa gryllotalpa* appears to have occurred as a native Yorkshire insect in the Doncaster district (1840s, 1950s) and possibly the Hull district (1905). However, the Hull specimen and perhaps also one from Sheffield (1965) may be casual

introductions. The specific determination of the Hull specimen is not entirely certain, which is underlined by the finding of a further example of mole-cricket, from York (1999). This has been identified as the non-native *G. africana*, and was clearly a chance immigrant.

Acknowledgements

I am grateful to Dr G. S. Oxford and J. P. Widgery (former organiser of the ORSBI) for initiating the events which led to the adding of African Mole-cricket to at least the Yorkshire list. Dr Oxford is also thanked for the provision of data on the circumstance of discovery of this specimen, and for donating it to Doncaster Museum & Art Gallery. My examination of orthopteroid insects at the Hull & East Riding Museum was facilitated by M. F. Stanley, and Dr P. Skidmore informed me of the Thorne Moors record of Mole-cricket.

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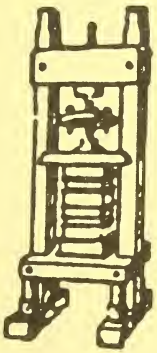

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July-September 2004

Number 1050
Volume 129

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A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record his deep appreciation of this imaginative gesture.

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AN UNPUBLISHED FLORA OF BARNSLEY AND DISTRICT

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Introduction

A manuscript flora of Barnsley & District has been preserved in the A. A. Dallman Archive at Liverpool Museum (Greenwood 1977). Although it was transcribed in 1922 by E. G. Bayford, it was based on an earlier MS (present location unknown), dating from around 1855-67 and attributed to "Drs Payne and Smith". Dr Payne is the Quaker physician Henry Payne; the identify of Dr Smith has not been confirmed.

South Yorkshire has been intensively botanised since the time of Jonathan Salt of Sheffield (1759-1815), whose list of plants preserved in his herbarium was published by Sheffield Public Museum (Howarth 1889). Thomas Waller Gissing's *Flora of Wakefield* (Gissing 1865-66) includes some records from the Don Valley catchment. Although a *Flora of the West Riding* appeared in 1862, no records from the Barnsley area could be traced therein and Dr Payne is included neither in the list of contributors nor subscribers (Miall & Carrington 1862: 95-97).

The first published Flora of Barnsley appears to be that of F. Batley in 1885-86 (Simpson 1960), but this was not cited in the bibliography of Lees' *Flora of West Yorkshire* and must have appeared after Lees' work went to press. Batley, whose biography does not appear in Desmond (1994), was possibly related to James Batley of Wentworth, gardener to the Vernon-Wentworth family. Thus it was not until 1888 that some of Payne and Smith's manuscript records first appeared in print. The manuscript is cited by Lees (1888) as "*Flora of the Dearne Valley* by Dr Payne of Wath, pp. 67, lent to the author in 1877. Many casuals included" [but see below] "and some erroneous records – the names not to be depended upon always, e.g. *Cicuta virosa*, 'Burton Grange', proved to be *Oe. crocata*". Where records are cited by Lees, the source is sometimes given as 'Payne's Flora, 1867', this date presumably being the year in which the account was written. The only dated records in the MS are from 1855. There is a tradition of compiling local floras hereabouts; a more recent example, again with Quaker input, is the *Ackworth Plant List* (Hall & Mendham 1948) covering an area just north of that treated in the present list.

Despite Lees' unwillingness to accept all of Payne's records, it is evident that he revisited some of the sites in order to confirm some of the rarer plants: cf. the note on p. 252 where "*C.[icuta] virosa* has never been found there by any reputable botanist" but where Lees found *Oenanthe crocata*.

Biographical notes

Arthur Augustine Dallman (1883-1963) is best known as the editor of the *North-Western Naturalist*, a journal that he published from 1926 to 1955. He worked mainly as a schoolteacher in Birkenhead and South Yorkshire. Despite his modest income, Dallman acquired a fine library of local Floras of the British isles (now at Liverpool Museum) and through his editorship he built up a large correspondence with northern naturalists, which is preserved in the Dallman archive at Liverpool Museum. He was also President of the Doncaster Scientific Society from 1921 to 1923 and in 1927.

Dr Henry Payne (d. 1895?) was a Quaker physician who helped to found the Barnsley Natural History Society in 1856. He is not listed in Desmond (1994). He lived in retirement at Newhill Hall, Wath-on-Dearne, and may also have occupied Loxley House near Sheffield where a doctor of that name lived in 1865. His co-worker is recorded as simply "Dr Smith"; his identity is unknown, but a possible candidate is Rev. Gerard Edwards Smith (1804-1881) who was vicar of Cantley near Doncaster from 1844-46 (Desmond 1994). As stated above, the only dated records (one albeit deleted) are from 1855, two

years before the birth of Payne's eldest son, John Henry Payne (1857-1931). Payne jnr. was an analytical chemist by profession. Educated at Bootham Friends' School in York, he worked in Jarrow and later in London before taking early retirement and moving back to South Yorkshire. He was, in the words of Dallman, an "ardent pedestrian" and was well known in the Doncaster area for his scholarly interests. His obituary appeared in *The North-Western Naturalist* (Dallman 1931). His herbarium is preserved at the National Museum of Wales, Cardiff. His published work mainly concerns fungi and bryophytes.

The compiler of the MS, E. G. Bayford of Barnsley, corresponded with A. A. Dallman between 1924 and 1948. Bayford was an expert coleopterist and a Fellow of the Royal Entomological Society. By 1946 he had attained 63 years' membership of the Barnsley Naturalist and Scientific Society, as reported in the *Barnsley Chronicle & South Yorkshire News* (Saturday 2 Nov. 1946, p. 7: cutting in Dallman Archive at LIV), and he was also active in the South Yorkshire Entomological Society in the 1930s.

TAXONOMIC NOTE

As the nomenclature of Bayford's MS follows Druce's *List of British Plants* (Druce 1908), the nomenclature will not reflect changes after that date. The title page of the MS is dated June 1922. Although Bayford would have had access to a copy of Lees' *Flora* he may not, as an entomologist, have felt confident in evaluating the quality of Payne's identifications.

As Bayford's transcript updated the nomenclature used in the original compilation, the original name is given in brackets where it differs from the currently accepted name (in bold). Where the presently accepted name reverts to Payne's original name, Bayford's synonymy has sometimes been omitted. The generic name is not normally repeated in the MS list, but here it is represented by its initial letter. Ditto marks have been replaced by the relevant text, and spellings have been expanded (e.g. Stainbro' is given as Stainborough). Current names follow Stace (1997); the family order and circumscription is that of the original flora, thus preserving the sequence of the original MS. pagination (in roman numerals). Species names which were capitalised in the MS are given in lower case, in accordance with modern practice.

MS copy of Local Flora of Barnsley & District, by Drs Payne and Smith, made, with the nomenclature revised by, E. G. Bayford FLS.

EXPLANATION OF METHOD ADOPTED.

a. number prefixed to each species indicates the consecutive order of original
b. Generic names, where changed, in the main are not indicated.
c. Specific names, where changed, have that used in the original added in brackets.
d. Erasures in the original are shewn by a line drawn through the record.
e. The nomenclature is that of G. C. Druce M.A., F.L.S. (Hayward's Bot. P.B. Ed. xiii, 1909).

E. G. Bayford. vj. 1922.

[i]

Ranunculaceae

19. **Thalictrum flavum**. Wet fields.
18. **T. minus**. Stony pastures.
3. **Anemone nemorosa**. Common in woods.
2. **Adonis annua** (autumnalis fide Bayford). Monk Bretton, in corn fields.
6. **Myosurus minimus**. Stainborough woods.
16. **Ranunculus repens**. Roadsides.
7. **R. acris**. Common. ~~Wath.~~
10. **R. auricomus**. Pastures and woods.
11. **R. bulbosus**. Meadows.
17. **R. sceleratus**. Cliff Wood, canal sides.

9. **R. arvensis**. Cornfields.
15. **R. lingua**. ? Cudworth, Wath.
13. **R. flammula**. Cudworth.
12. **R. ficaria**. Woods and pastures.
14. **R. hederaceus**. Dearne meadows.
4. **Caltha palustris**. Common.
5. **Helleborus viridis**. Stainborough Park. Naturalised.
1. ~~Aconitum napellus. Rob Royd. 1855.~~
Berberidaceae
20. **Berberis vulgaris**. Hedges and thickets.
Nymphaeaceae

[ii]
21. **Nuphar lutea** (Nymphaea lutea fide Payne).
Papaveraceae
24. **Papaver rhoeas**. In cornfields.
32. **P. dubium**. Nr. Beckett's Croft.
22. **P. argemone**. Nr. Beckett's Croft.
23. **Chelidonium majus**. Wath.
Fumariaceae
24. **Ceratocapnos clagiculata** (Corydalis claviculata fide Payne).
25. **Fumaria capreolata**. Common. Cudworth.
26. **F. officinalis**. Common.
27. F. **densiflora** (micrantha sensu Bayfield). Fields. Doubtful.
Cruciferae.
28. **Erysimum cheiri** (Cheiranthus cheiri fide Payne). Monk Bretton Priory.
29. **Rorippa nasturtium-aquaticum** (Nasturtium officinale fide Payne). Rivulets.
30. **Barbarea vulgaris**.
31. **Cardamine pratensis**.
32. **C. amara**. New Miller Dam, Dearne meadows & Stainbro wood.
33. **C. hirsuta**.
34. **Descurainia sophia** (Sisymbrium sophia fide Payne).
37. **Sisymbrium officinale**.
38. **Arabidopsis thaliana** (S. thalianum fide Payne).
39. **Alliaria petiolata** (Sisymbrium alliaria fide Payne).
34. **Erophila verna** (Draba verna fide Bayfield).
35. **Armoracia rusticana**. New Miller Dam.

[iii]
40a. **Brassica rapa** subsp. **campestris** (B. campestris sensu Bayfield, B. napus sensu Payne).
40b. **B. rapa** subsp. **oleifera** (B. rapa sensu Payne).
41. **Sinapis arvensis** (B. arvensis sensu Payne). Cornfields.
42. **S. alba** (Brassica alba sensu Payne). Cultivated land.
43. **Capsella bursa-pastoris**.
44. **Raphanus raphanistrum**.
Resedaceae
45. **Reseda luteola**. Canal banks.
Violaceae
46. **Viola riviniana** (V. sylvestris sensu Payne).
47. **V. canina**.
48. **V. odorata**.
49. **V. tricolor**.
Polygalaceae

50. **Polygala vulgaris**.
Caryophyllaceae
51. **Cucubalus baccifer** (Silene inflata sensu Payne).
52. **Silene noctiflora**. Woolley Park.
53. **Lychnis flos-cuculi**. Fields.
54. **Silene dioica** (Lychnis dioica sensu Payne). Fields.
55. **Agrostemma githago** (Lychnis githago sensu Payne).
56. **Cerastium fontanum** subsp. **vulgare** (C. vulgatum sensu Payne).
57. **C. glomeratum** (C. viscosum sensu Payne).
58. **C. semidecandrum**.

[iv]
59. **Myosoton aquaticum** (Stellaria aquatica sensu Payne). Wet places. Ponds & rills.
60. **S. nemorum**. Stainborough.
61. **S. media.**
62. **S. holostea**.
63. **S. graminea**.
64. **S. uliginosa**.
65. **Arenaria serpyllifolia**. Barebones.
66. **Sagina apetala**.
Portulacaceae
156. **Montia fontana**.
Hypericaceae.
68. **Hypericum calycinum**. Nr. aqueduct. Canal.
69. **H. pulchrum**.
70. **H. tetrapterum** (H. quadrangulum sensu Payne).
71. **H. perforatum**.
72. **H. humifusum**. Wath.
Malvaceae
73. **Malva moschata**. Darfield. Rockley.
74. **M. sylvestris**. Wath.
75. **M. pusilla** (M. rotundifolia sensu Payne).
Tiliaceae
76. **Tilia x europaea** (T. europaea sensu Payne).
Linaceae
77. **Linum usitatissimum**. Bank Top.
78. **L. catharticum**. Aqueduct.

[v]
Geraniaceae
79. **Geranium pratense**
80. **G. pyrenaicum**. Windhill.
81. **G. dissectum**. Wath.
82. **G. molle**.
83. **G. pusillum**. Windhill.
84. **G. robertianum**.
85. **Erodium cicutarium**. Ardsley.
Oxalidaceae
86. **Oxalis acetosella**. Stainborough, Burton &c.
Aquifoliaceae
244. **Ilex aquifolium**. Lund Wood.
Leguminosae.
88. **Genista tinctoria**. Beyond Stainborough. Nr Darton.
87. **Ulex europaeus**. Common.

80. **Cytisus scoparius** (C. scoparium sensu Payne).
90. **Ononis repens** (arvensis sensu Bayfield). Wentworth.
91. **Medicago sativa**. Fields. Escaped from culture.
93. **M. arabica** (maculata sensu Payne).
92. **M. lupulina**.
94. **Melilotus officinalis**. Darfield.
95. M. arvensis? Darfield. Doubtful record. It is possible that record no. 94 refers to **M. altissimus** (the native species) and 95. to **M. officinalis** (=M. arvensis fide Wilmore).
98. **Trifolium medium**. Royston.
97. **T. pratense**. Pastures.
99. **T. arvense**. Shafton. Gooddy's farm.
100. **T. repens**. Pastures.
101. **T. campestre** (T. procumbens sensu Payne). Westwood.
96. **T. dubium** (T. filiforme sensu Payne).

[vi]
105. **Anthyllis vulneraria**. Woolley Farm.
102. **Lotus corniculatus**.
104. **L. pedunculatus** (L. corniculatus var. major sensu Payne)
103. **L. glaber** (L. tenuis sensu Payne). Wath.
106. **Astragalus danicus** (A. hypoglottis sensu Payne). Woolley Farm.
118. **Ornithopus perpusillus**.
110. **Vicia sylvatica**. Bretton Woods.
112. **V. cracca**. Stamper's Hill nr Birdwell.
111. **V. ?sylvatica** (V. orobus sensu Payne). Wharncliff.
113. **V. sepium**. Woolley.
115. **V. sativa**. Cudworth.
114. **V. sativa subsp. nigra** (V. angustifolia sensu Payne). Bretton.
107. **V. hirsuta**. Woolley.
108. **V. tetrasperma**. Cudworth.
109. **V. parviflora** (V. gracilis sensu Payne). Windhill.
117. **Lathyrus ?latifolius** (L. sylvestris sensu Payne).
116. **L. pratensis**.

Rosaceae

120. **Prunus cerasus**. Cliff wood.
119. **P. spinosa**.
121. **Filipendula ulmaria** (Spiraea ulmaria sensu Payne). Canal sides.
133. **Rubus idaeus**. Cliff wood.

[vii]
132. **Rubus fruticosus**.
135. **R. cardiophyllus** (R. fruticosus subsp. rhamnifolius sensu Payne). Silkston. Doubtful record.
134. **R. leucostachys** (R. fruticosus subsp. leucostachys sensu Payne). Cliff wood.
136. **R. radula** (R. fruticosus subsp. radula var. denticulatus sensu Payne). Beyond Tankersley. Not recorded for VC63 in Edees & Newton (1988).
137. **Geum urbanum**.
138. **G. rivale**.
131. **Fragaria vesca**. Stainborough woods.
127. **Potentilla anserina**. Roadsides.
128. **P. reptans**.
130. **P. erecta** (P tormentilla sensu Payne). Silkston.
129. **P. sterilis** (P. fragariastrum sensu Payne). Common.
125. **Alchemilla vulgaris** agg. Woolley, Parson's Lane.
126. **Aphanes arvensis** (Alchemilla arvensis sensu Payne). Woolley.

124. **Agrimonia eupatoria** (A. eupatorium sensu Payne). Woolley. West Melton.
122. **Sanguisorba minor** (Poterium sanguisorba sensu Payne). Woolley.
140. **Rosa arvensis**. Lund wood.
139. **R. canina**. Common.
143. **Rosa rubiginosa** (R. eglanteria sensu Bayford) Silkston.
142. **R. tomentosa** (R. mollis[s]ima sensu Bayford). Street, nr Wentworth.
141. **R. pimpinellifolia** (R. spinosissima sensu Payne). Wath.
146. **Malus sylvestris** (Pyrus malus sensu Payne). Notton.
145. **Pyrus communis**. Notton.
147. **Sorbus aucuparia** (P. aucuparia sensu Payne). Woolley wood.
148. **Sorbus aria** (P. aria sensu Payne). Gawber wood. New Miller Dam. Interesting records, according to M. Wilcox (pers. com.) as S. intermedia is common in the area.

[viii]
144. **Crataegus monogyna** (C. oxyacantha sensu Payne). Common.
Saxifragaceae
163. [Saxifraga granulata (crossed out). Redbrook.]
164. **Chrysosplenium alternifolium**. Nr Pilley Green.
165. **C. oppositifolium**. Rob Royd.
161. **Ribes uva-crispa** v[ar]. grossularia. Cliff wood. Storr's Mill.
162. **R. nigrum**. Lower Cudworth. (probably planted).
Crassulaceae
158. **Sedum telephium**. Cultivated land, Rockley
159. **S. rupestre** (S. reflexum fide Payne). Rare.
157. **S. acre**.
160. **Sempervivum tectorum**. Walls & roofs of old buildings.
Epilobiaceae [sic] (**Onagraceae**)
149. **Chamerion angustifolium** (Epilobium angustifolium sensu Payne). Lund wood. Cold Hiendley Common.
150. **Epilobium hirsutum**. Rob Royd.
151. **E. parviflorum**. Woolley.
153. **E. tetragonum**. Wath.
152. **E. montanum**. Wortley.
Cucurbitaceae
154. **Bryonia dioica**.
Umbelliferae.
166. **Hydrocotyle vulgaris**. Marshy places.
167. **Sanicula europaea**. Woods nr Wortley.
182. **Conium maculatum**. Nr Darfield.
169. [Apium graveolens. (crossed out). Cliff Wood.]

[ix]
168. **Cicuta virosa**. Nr Burton Grange (see Introduction).
170. **Berula erecta** (Sium angustifolium sensu Payne). Ditches.
181. **Myrrhis odorata**. Nr Birthwaite.
179. **Scandix pecten-veneris**.
180. **Anthriscus sylvestris**.
172. **Oenanthe aquatica** (phellandrii sensu Bayford). Ponds & ditches.
173. **O. crocata**. Wet land.
171. **O. fistulosa**. Ponds & ditches.
174. **Aethusa cynapium**. Burton &c.
183. **Angelica sylvestris**.
176. **Heracleum sphondylium**.
175. **Daucus carota**.

177. **Torilis japonica** (Caucalis anthriscus sensu Payne).
178. **Torilis arvensis** (C. infesta sensu Payne).

Araliaceae

184. **Hedera helix**. Common.

Cornaceae

184a. **Cornus sanguinea**. Hedges.

Caprifoliaceae

185. **Adoxa moschatellina**. Near Cawthorne &c.
187. **Sambucus nigra**.
189. **Viburnum opulus**. Stainborough woods.
188. **Lonicera periclymenum**.

Rubiaceae

[x]

196. **Galium mollugo**. Silkston.
195. **G. saxatile**. Waste places.
194. **G. uliginosum**. Lower Cliff wood.
193. **G. palustre**. Rivulet nr Swithen (?misreading of Swinton)
191. **G. verum**. Woolley Edge.
197. **G. aparine**. Stainborough.
192. **Cruciata laevipes** (G. cruciata sensu Payne). Hedges &c.
190. **Galium odoratum** (Asperula odorata sensu Payne). Woods, Stainborough &c.

Valerianaceae

198. **Valeriana officinalis**. Woolley & Rockley.
199. **V. dioica**. Dearne meadows.
200. **Valerianella locusta** (V. olitoria sensu Payne). Cornfields.
201. **V. carinata**. Havercroft.

Dipsacaceae

203. **Succisa pratensis** (Scabiosa succisa sensu Payne).
202. **Knautia arvensis** (Scabiosa arvensis sensu Payne).

Compositae.

204. **Eupatorium cannabinum**. Wath.
209. **Solidago virgaurea**. Wentworth.
208. **Bellis perennis**. Common.
207. **Erigeron acer** (E. acris sensu Payne). Wentworth.
210. **Inula conyza**. Hermit Hill, 1855. Smithley.
257. **Filago vulgaris** (F. germanica sensu Bayfield). Wentworth.
256. **F. minima**. Hoober.

[xi]

255. **Antennaria dioica**. Hoober.
211. **Pulicaria dysenterica**. Bolton. Carlton.
233. **Bidens cernua**. Worsborough reservoir.
234. **B. tripartita**. Canal bank.
213. **Achillea millefolium**. Roadsides &c.
212. **A. ptarmica**. Hoylandswaine. Carlton.
215. **Chrysanthemum segetum**. Fields.
214. **Leucanthemum vulgare** (C. leucanthemum sensu Payne). Fields.
235. **Tanacetum parthenium** (C. parthenium sensu Payne).
216. **Matricaria recutita** (M. chamomilla sensu Payne).
219. **Tanacetum vulgare**. Willthorp.
217. **Artemisia absinthium**. Nr Haigh.
218. **A. vulgaris**.
206. **Tussilago farfara**. Clayfields.

205. **Petasites hybridus** (P. vulgaris sensu Payne). Dearne & Dove.
263. **Senecio aquaticus**.
262. **S. jacobaea**. Waste grounds.
260. **S. erucifolius**. Worsboro'.
261. **S. viscosus**. Nr Crigglestone. Very rare.
259. **S. sylvaticus**. Burton.
258. **S. vulgaris**. Common.
231. **Arctium lappa** (A. major sensu Payne). Swallow Hill.
232. **A. minus**. Nr Royd Green.

[xii]
267. **Carduus nutans**. Mexborough.
268. **C. crispus**. Mexborough.
269. **Cirsium vulgare** (C. lanceolatum sensu Payne).
271. **C. arvense**.
270. **C. palustre**.
264. **Centaurea nigra**. Royston.
265. **C. cyanus**. Burton.
266. **C. scabiosa**. Carlton.
272. Cichorium intybus.
277. **Picris echioides**.
276. **P. hieracioides**. Railway banks.
225. **Crepis paludosa**. Silkston Fall.
224. **C. capillaris** (C. virens sensu Bayford).
226. **Pilosella aurantiaca** (Hieracium pilosella sensu Payne). Waste places.
227. **Hieracium murorum** agg.
228. H. murorum v[ar]. vulgatum. Denby woods.
273. **Hypochaeris radicata**.
229. **Leontodon hispidus**.
230. **L. autumnalis**.
220. **Taraxacum vulgare** agg. Common.
221. **T.** sect. **Erythrosperma** (T. vulgare v[ar]. laevigatum sensu Payne). Dearne Valley.
222. **Sonchus arvensis**. Cornfields.
223. **S. oleraceus**. Common.

[xiii]
274a. **Tragopogon pratensis** subsp. **minor** (T. pratensis sensu Payne).
274b. **T. pratensis** subsp. **pratensis** (T. pratensis v[ar]. major sensu Payne).
Campanulaceae
236. **Jasione montana**. Cheveh.
238. **Campanula latifolia**.
237. **C. rotundifolia**. Sunny Bank & Lund woods.
Vacciniaceae
241. **Vaccinium myrtillus**. Lund Wood.
242. **V. vitis-idaea**. Low Valley.
243. **V. oxycoccos** (Oxycoccus quadripetalus sensu Payne). High Green.
Ericaceae
240. **Erica cinerea**. Hunter's Farm.
239. **E. tetralix**. Hunter's Farm.
–. **Pyrola minor**. Woods nr Thorncliff.
Primulaceae
345. **Primula vulgaris.**
346. **P. veris.**
278. **Lysimachia nummularia**.

279. **L. nemorum**. Stainborough.
280. **Anagallis arvensis**. Woolley &c.
Oleaceae
246. **Fraxinus excelsior** (F. elatior sensu Payne). Woods.
245. **Ligustrum vulgare**. Rob Royd.
Apocynaceae
247. **Vinca minor**. New Miller Dam.

[xiv]
Gentianaceae
248. **Centaurium erythraea** (C. umbellatum sensu Bayford). Pilley &c.
Menyanthaceae (included in Gentianaceae by Bayford)
249. **Menyanthes trifoliata**. Stream nr Stamper's Hill.
Convolvulaceae
251. **Calystegia sepium**. Hedges.
250. **Convolvulus arvensis**. Fields.
252. **Cuscuta epilinum** (C. vulgaris sensu Bayfield). Upon Flax nr Denby Hall, 1855. First and only record for Yorkshire, and now extinct. Payne's 1855 record is incorrectly dated 1888 and attributed to Lees by Wilmore (2000, p. 136).
254. **C. europaea**. Barnby Farm.
253. **C. epithymum**. Cawthorn.
Boraginaceae
299. **Myosotis scorpioides** (M. palustris sensu Payne) Cliff wood side.
303. Recorded as M. palustris v[ar]. repens: modern identification unclear. Nr Wentworth.
300. **M. sylvatica**. Stainborough.
301. **M. arvensis** (M. scorpioides sensu Bayfield). Fields.
302. **M. discolor (**M. versicolor sensu Payne). Meadows.
304. **Lithospermum arvense**.
Solanaceae
306. **Solanum dulcamara**. Fanning wood.
305. **S. nigrum**. Nr Hoyland.
307. **Atropa belladonna**. Woolley Heights. Rare. 1855.
Scrophulariaceae
309. **Verbascum thapsus**. Darton.
321a. **Linaria vulgaris**.
321c. **Chaenorrhinum minus** (L. minor sensu Payne). Cornfields, Worsbrough.
321b. **Kickxia elatine** (L. elatine sensu Payne). Cornfields, Redbrook.

[xv]
321. **Scrophularia auriculata** (S. aquatica sensu Payne).
321bis. **S. nodosa**.
310. **Digitalis purpurea**. Common.
320. **Veronica officinalis**. Dry banks.
318. **V. chamaedrys**. Hedgerows.
317. **V. beccabunga**.
315. **V. anagallis-aquatica** (V. anagallis sensu Payne). Rivulet at Rob Royd.
316. **V. serpyllifolia**. Woods, Stainborough.
319. **V. agrestis**.
321d. **Euphrasia officinalis** agg.
321e. **Odontites vernus** (Bartsia odontites).
312. **Pedicularis palustris**. Stainborough &c.
313. **P. sylvatica**. Cranemoor wood.
314. **Rhinanthus minor**, or possibly R. angustifolius (R. crista-galli sensu Payne). Fields.
311. **Melampyrum pratense**. Cliff wood.

Orobanchaceae
308. **Lathraea squamaria**. Stainborough.
Verbenaceae
344. **Verbena officinalis**. Wath.
Lamiaceae
322. **Mentha aquatica** (M. hirsuta sensu Bayford)
323. **M.** x **piperita** (M. piperita sensu Payne). Carlton Lanes.
324. **Thymus pulegioides** (T. chamaedrys sensu Payne).
325. **T. serpyllum.**

[xvi]
343. **Clinopodium vulgare** (Satureja vulgaris sensu Bayford). Canal banks at Woolley.
328. **Glechoma hederacea** (Nepeta hederacea sensu Bayford). Hedges &c.
327. **Scutellaria galericulata**.
326. **S. minor**. Haigh nr rivulet.
329. **Prunella vulgaris.**
340. **Marrubium vulgare**. Silkston.
337. **Stachys sylvatica**.
339. **S. palustris**. Darfield.
338. **S. arvensis**.
336. **S. officinalis**. Carr Green.
342a. **Galeopsis tetrahit v[ar]**. versicolor. Cornfields. Burton.
330. **Lamium album**.
331. **L. purpureum**.
332. **L. hybridum** (L. incisum sensu Payne).
333. **L. amplexicaule**.
334. **Lamiastrum galeobdolon** (Lamium galeobdolon sensu Payne). Rob Royd, Aldham &c.
335. **Ballota nigra**.
341. **Teucrium scorodonia**. Common.
342. **Ajuga reptans**. Common.
Plantaginaceae
281. **Plantago lanceolata**. Common.
282. **P. media**.
283. **P. major**.
Illecebraceae
155. **Scleranthus annuus**. Cudworth.

[xvii]
Chenopodiaceae
285. **Chenopodium bonus-henricus**.
286. **C. album**.
284. **C. polyspermum**.
286a. **Atriplex patula**. Way-sides, dunghills.
286b. **A. patula** v[ar]. angustifolia. Way-sides, dunghills.
Polygonaceae
296. **Fallopia convolvulus** (Polygonum convolvulus sensu Payne).
293. **Polygonum bistorta**. Meadows.
297. **Persicaria amphibia** (Polygonum amphibium sensu Payne).
347. **P. lapathifolia** (Polygonum lapathifolium sensu Payne).
298. **P. maculosa** (Polygonum persicaria sensu Payne).
348. **P. hydropiper**. Near Friar's Well.
294. **Polygonum aviculare**.
295. **Fagopyrum esculentum** (F. sagittatum sensu Payne).

287. **Rumex hydrolapathum** (R. hydrdolapathi sensu Payne).
288. **Rumex crispus**.
291. **R. obtusifolius**. Partridge Dale woods.
292. **R. sanguineus** (R. nemolapathum sensu Payne).
289. **R. acetosa**. Fields.
290. **R. acetosella**.

Loranthaceae

186. **Viscum album**. Rockley.

[xviii]

Euphorbiaceae

353. **Euphorbia helioscopia**.
351. **E. amygdaloides**. Woods.
354. **E. exigua**. Burton.
350. **E. officinalis**: possibly spham. for E. officinarum?
349. **Buxus sempervirens**. Woods.
352. **Mercurialis perennis**. Common.

Ulmaceae

358, 359. **Ulmus minor** (U. sativa; U. suberosa et campestris sensu Payne?). Woods. Evidently two species were originally recorded by Payne, and given different numbers, but were later subsumed into one species "U. sativa" by Bayford. I have been unable to trace this name as a synonym.

Urticaceae

357. **Humulus lupulus**.
356. **Urtica dioica**. Common.
355. **U. urens**. Common.

Amentaceae [sic, incl. **Betulaceae** & **Fagaceae**]

370. **Betula pubescens** (B. alba sensu Payne). Stainborough.
371. **Alnus glutinosa** (A. rotundifolia sensu Payne). Dearne side.
378. **Carpinus betulus**. Common.
376. **Corylus avellana**. Common.
374. **Quercus robur** (Q. pedunculata sensu Payne). Common.
375. **Q. petraea** (Q. sessiliflora sensu Payne). Lund Wood.
373. **Castanea sativa** (C. vulgaris sensu Payne). Doubtful native. Common.
372. **Fagus sylvatica**. Stainborough &c.

Salicaceae

[xix]

360. **Salix fragilis**.
361. **S. alba** var. **caerulea** (S. alba sensu Payne). Darfield.
362. **S. alba** var. **vitellina**. Darfield.
363. **S. viminalis**.
364. **S. viminalis** v[ar]. acuminata.
366. **S. caprea**.
365. **S. cinerea**.
367. **Populus alba**. Darfield.
368. **P. tremula**. Woods.
369. **P. nigra**. Dearne side.

Hydrocharitaceae

383. **Elodea canadensis** (Anacharis alsimastrum sensu Payne). Canal beyond Notton, Hiendley.

Orchidaceae

290. **Listera ovata**.
391. **L. cordata**. Stainborough Park.

389. **Epipactis latifolia** (Helleborine latifolia sensu Payne). Wentworth & Rockley.
384. **Orchis morio**.
386. **Dactylorhiza traunsteineri** (O. latifolia sensu Payne).
387. **Dactylorhiza maculata** (O. maculata sensu Payne).
385. **Orchis mascula**. Stainborough.
388. **Coeloglossum viride** (Habenaria viridis sensu Payne). Gawber.

Iridaceae

392. **Iris pseudacorus**. Littleworth & New Miller Dam.

Dioscoreaceae

382. **Tamus communis**. Hedges &c.

[xx]

Liliaceae

394. **Allium scorodoprasum** (A. arenarium sensu Payne). Hedges.
393. **A. ursinum**. Rob Royd.
396. **Hyacinthoides non-scripta** (Scilla nutans sensu Payne). Common in woods.
395. **Ornithogalum angustifolium** (O. umbellatum sensu Payne). Royston.
381. **Paris quadrifolia**. Rockley. Wood nr Gawber.

Juncaceae

397. **Juncus effusus** (J. acutus var. effusus sensu Payne). Stainborough.
398. **J. conglomeratus**. Common in damp places.
399. **J. inflexus** (J. glaucus sensu Payne). Willthorp.
400. **J. acutiflorus**. Canal side. Old Mill.
401. **J. articulatus** (J. lamprocarpus sensu Payne). Silkston.
402. **J. compressus**. Silkston.
403. **Luzula sylvatica**. Cudworth.
404. **L. pilosa**. Cudworth.
405. **L. campestris**. High Stile Fields.

Typhaceae

410. **Typha latifolia**. Barnugh, in canal. Hiendley reservoir, &c.
411. **Sparganium erectum subsp. erectum** (S. ramosum sensu Payne). West Milton.

Araceae

412. **Arum maculatum**. Hedge banks above Lund hill.
413. **Acorus calamus.** Canal bank at Ardsley.

Lemnaceae

[xxi]

414. **Lemna trisulca**. In Stainborough reservoir previous to the water being run off.
415. **L. minor**. In Stainborough reservoir previous to the water being run off.

Alismataceae

406. **Alisma plantago-aquaticum** (A. plantago sensu Payne). Canal.
407. **Baldellia ranunculoides** (Echinodorus ranunculoides sensu Payne). Hiendley reservoir.
408. **Sagittaria sagittifolia.** Wombwell canal.

Naiadaceae

409. **Triglochin palustre**. Wath.
416. **Potamogeton natans**. Rivulet Swithen.
417. **P. polygonifolius** (P. oblongus sensu Payne).
418. **P. coloratus** (P. plantagineus sensu Payne). Nr Barugh. Lost by drainage.
422. **P. gramineus**. Canals.
419. **P. lucens**. Canals.
420. **P. perfoliatus**. Lane in Woolley Park.
421. **P. crispus**. Canals.

Cyperaceae
423. **Eleocharis palustris**.
424. **E. acicularis**.
426. **Scirpus sylvaticus**. Cliff wood side.
425. **Schoenoplectrus lacustris** (Scirpus lacustris sensu Payne). Ponds &c. West Melton.
422. **Trichophorum cespitosum** subsp. **germanicum** (S. caespitosus sensu Payne). Banks of reservoir.
441. **Carex hirta**. Swithin. Lost by drainage.
440. **C. sylvatica**. Cudworth wood.

[xxii]
439. **C. binervis**. Clayton Heights.
438. **C. caryophyllea** (C. praecox sensu Payne). Blacker Hill.
436. **C. panicea**. Bloomhouse Green.
437. **C. limosa**. Bog nr Wortley.
434. **C. acuta.**
435. **C. nigra** (C. goodenowii sensu Bayford, C. vulgaris sensu Payne). Nr Day House.
433. **C. ovalis** (C. leporina sensu Bayford). Durton.
431. **C. echinata** (C. stellulata sensu Payne).
432. **C. curta** (C. canescens sensu Bayford).
428. **C. muricata**. Wortley.
430. **C. remota** (C. axillaris sensu Payne). Royston 1855.
429. **C. divulsa**. Wortley.
427. **C. dioica**. Stainborough.
Graminaceae [sic] (**Poaceae**)
442. **Anthoxanthum odoratum**. Pastures, woods.
444. **Alopecurus pratensis**. Pastures.
445. **A. myosuroides** (A. agrestis sensu Payne). Pastures.
446. **Milium effusum**. Woods.
443. **Phleum pratense**. Pastures.
447. **Agrostis capillaris** (A. tenuis sensu Bayford, A. vulgaris sensu Payne). Dry land.
448. **Calamagrostis epigeios**. Damp places.
451. **Aira caryophyllea**. Dry places.
449. **Deschampsia caespitosa**. Meadows.
450. **D. flexuosa**. Heathy places.

[xxiii]
456. **Holcus mollis**. In light soils.
455. **H. lanatus**. Hedges.
452. **Avena fatua**. Corn fields.
453. **A. strigosa**. Corn fields.
454. **Arrhenatherum elatius** (A. avenaceum sensu Payne). Hedges & pastures.
470. **Cynosurus cristatus**. Pastures.
457. **Koeleria macrantha** (K. gracilis sensu Bayford, K. cristata sensu Payne). Bank Top.
458. **Molinia caerulea**. Wet places.
471. **Dactylis glomerata**. Meadows.
469. **Briza media**. Common.
462. **Poa pratensis**. Common.
461. **P. trivialis**. Shady places.
460. **P. nemoralis**. Shady places.
463. **P. compressa.** Dry places.
464. **P. compressa** v[ar]. polynoda. Old quarries. Payne's record is cited in Lees (1888), p. 489 under **P. compressa** with the comment "This varies much, and many forms have been discriminated". The variety is no longer recognised.

459. **P. annua**. Common.
465. **Glyceria maxima** (G. aquatica sensu Payne). Pond sides.
466. **G. fluitans**. Stagnant water.
467. **G. notata** (G. fluitans v[ar]. plicata sensu Payne). Stagnant water.
468. **Desmazeria rigida** (Festuca rigida sensu Payne). Dry places.
473. **Festuca gigantea**. Damp woods.
476. **F. arundinacea**. Banks.
475. **F. pratensis** (F. elatior sensu Bayfield). Wet fields.
474. **F. ovina**. Hilly pastures.
472. **Vulpia bromoides** (Festuca bromoides sensu Payne). Dry fields &c.

[xxiv]
478. **Anisantha sterilis** (Bromus sterilis sensu Payne). Swinton.
480. **A. diandra** (B. madritensis var. diandrus sensu Payne). Dry sandy fields.
477. **Bromopsis ramosa** (Bromus ramosus sensu Bayfield, B. asper sensu Payne). Damp woods.
479. **B. erecta** (Bromus erectus sensu Payne). Dry sandy fields.
481. **Bromus secalinus**. Corn fields.
484. **B. racemosus**. Common.
482. **B. commutatus** (B. racemosus var. commutatus sensu Payne). Common.
483. **B. hordeaceus** subsp. **hordeaceus** (B. mollis sensu Payne). Common.
485. **Brachypodium sylvaticum**. Woods.
490. **Lolium temulentum**. Cultivated fields.
489. **L. multiflorum** v[ar]. italicum. Cultivated land. Prob[ably] intro[duce]d.
488. **L. perenne**. Common.
487. **Elytrigia repens** (Agropyron repens sensu Payne). Common.
493. **Nardus stricta**. Old collieries.
491. **Hordeum secalinum** (H. pratense sensu Payne). Damp pastures.
492. **H. murinum**. Waste land.

Pinaceae
379. **Taxus baccata**. Stainborough.
380. **Pinus sylvestris**. Common. Alien.

Equisetaceae
495. **Equisetum telmateia** (E. maximum sensu Bayfield). Reservoir sides.
494. **E. arvense**. Damp land, canal banks.
497. **E. sylvaticum**. Wet shaded places.
496. **E. hyemale** (E. limosum sensu Payne). Rockley lake &c.
498. **E. palustre**. Bogs.

[xxv].

Polypodiaceae
507. **Pteridium aquilinum** (Pteris aquilina sensu Payne). Woods, common.
506. **Phyllitis scolopendrium**. Old pit shaft, Willthorp.
504. **Asplenium adiantum-nigrum**. Rockley Abbey.
505. **A. ruta-muraria**. Rockley Abbey.
503. **Athyrium filix-femina**. Stainborough.
501. **Dryopteris filix-mas**. Common, woods.
502. D. dilatata (D. aristata sensu Payne). Eyning wood.
499. **Polypodium vulgare**. Stainborough etc.
500. **Phegopteris connectilis** (P. phegopteris sensu Payne). Storr's Mill.

Ophioglossaceae
508. **Ophioglossum vulgatum**.

Characeae
509. **Nitella flexilis**. Canal sides.

Evidence of vegetational change

One of the most interesting aspects of such an early list is the snapshot it provides of the impact of changes in land-use on the local flora. Having been compiled largely prior to the advent of the railways, the list nevertheless records the impact of the industrial revolution, as is shown in the following table.

Habitat feature	**No. of records**
Canal, aqueduct	19
Reservoir, dam	12
Ponds, ditches	5
Mill	3
Old pit shaft, old collieries	2
Old quarries	1
Railway banks	1
Walls and roofs of old buildings	1

Evidence is also provided of previous local extinctions: *Potamogeton coloratus* and *Carex hirta* were 'lost by drainage'. The only record of *Cuscuta epilinum* in Lees (1888) is that of Payne; the species is now extinct in Yorkshire, and indeed in Britain. The other noteworthy feature of the list is how few non-native species are actually described as introductions. Only five or six species fall into this category: *Helleborus viridis* ('naturalised'), *Sinapis alba* ('cultivated land'), *Medicago sativa* ('escaped from culture'), *Lolium multiflorum* 'cultivated land, probably introduced'), *Ribes nigrum* ('probably planted') and *Pinus sylvestris* ('alien').

Wilmore (2000) records *Helleborus viridis* only from VC 61, so the present record appears to be the first for VC 63. *Medicago sativa* subsp. *sativa* is 'common', having first been recorded from near Sheffield by Salt. Wilmore quotes Gibson's 1843 record as the earliest for *Lolium multiflorum*. *Pinus sylvestris* and *Ribes nigrum* are also given by Wilmore for VC 63, but as they are native elsewhere in Britain they are mentioned only in an appendix. The earliest record for *Sinapis alba* for VC 61 is given by Wilmore as 1900; if the date of Payne & Smith's record is taken as 1855 it is close to being the first Yorkshire record, which was made by Backhouse near York and was published in Baker and Nowell (1854).

The transcriber of the Flora, E. G. Bayford, was evidently interested in plant introductions, as he mentioned a newly established *Hieracium* and a *Euphorbia* at Worsbrough Reservoir in a letter to A. A. Dallman dated 21 June 1937: "they may have been important with some of the commodities required for pheasant rearing which is extensively carried on here".

Acknowledgements

I am grateful to Professor Mark Seaward and Dr Leander Wolstenholme for their valuable suggestions for improvements to the article.

GAZETTEER OF PLACE NAMES

Places that can be located on the Ordnance Survey 1:50,000 sheets for Barnsley and Doncaster have been given four-figure grid references.

Aldham SE 37.04
Ardsley, canal bank at SE 37.05
Bank Top
Barebones
Barnby Farm SE 61.09
Barnough, in canal ? = Barugh, SE 31.08
Beckett's Croft
Birdwell SE 34.01
Bolton (now Bolton upon Dearne) SE 45.02.
Bretton Woods SE 36.07.
Burton (=Monk Bretton) SE 36.07
Burton Grange SE 38.06
Carlton SE 36.10
Carr Green
Cawthorne SE 28.08
Clayfields
Cliff Wood or Lower Cliff Wood
Cold Hiendley Common SE 37.14
Cranemoor wood SE 30.01
Crigglestone SE 31.15
Cudworth, Lower Cudworth SE 38.08
Darfield, SE 41.04
Darton SE 31.10
Day House
Dearne SE 46.04
Dearne valley SE 40
Denby Hall SE 24.08
Denby woods ? SE 22.08
Dove (river) SE 39.04
Fanning Wood
Friar's Well
Garfield
Gawber SE 32.07
Gooddy's Farm (Shafton) SE 39.11.
Haigh SE 29.11 (rivulet near)
Havercroft SE 39.13.
Hermit Hill SE 32.00.
Hiendley (=Wintersett) reservoir) SE 37.15
High Green SK 33.97
High Style fields
Hoober SK 41.98
Hoyland SE 36.00 or 26.05 (Hoyland Swaine)
Hunter's Farm
Littleworth SK 62.98
Lower Cudworth SE 38.08
Low Valley
Lund Hill
Lundwood SE 37.07
Mexboro' (now Mexborough) SE 47.00
Monk Bretton priory SE 36.07
New Miller Dam SE 33.15
Notton SE 34.13
Notton, canal beyond SE 36.13
Old Mill, canal side
Parson's Lane
Partridge Dale woods ? SK 65.96
Pilley SE 33.00
Redbrook SE 32.07
Rob Royd
Rockley Abbey, Rockley lake SE 33.02
Royd Green SE 21.03
Royston SE 35.11
Shafton, Gooddy's Farm SE 39.11
Silkston (=Silkstone) SE 28.05
Silkston Fall SE 29.05
Smithley SE 38.03
Stainbro' (=Stainborough) Park SE 31.03
Stainbro' (=Stainborough) Wood SE 31.03
Stamper's Hill near Birdwell ? SE 34.01
Stamper's Hill, stream near
Storr's Mill
Sunny Bank
Swallow Hill SE 32.09
Swinton SK 45.98
Swithern, Swithin
Tankersley SK 34.98
Thorncliff, woods SE 21.13
Wath SE 44.00
Wentworth [castle] SE 31.03
West Melton SE 42.00
Wharncliff (=Wharncliffe) SK 29.94
Willthorp (=Wilthorpe) SE 33.07
Windhill SE 48.00
Wombwell canal SE 40.03
Woolley SE 31.13
Woolley, canal banks at
Woolley Park SE 32.13
Worsboro' (=Worsborough) reservoir, SE 34.03
Wortley SK 30.99

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BOOK REVIEWS

A Checklist of the Downy Mildews (*Peronosporaceae*) of the British Isles by **T. F. Preece.** Pp. 33. British Mycological Society. 2002. £4.50 (including postage) from BMS Librarian, Royal Botanic Garden, Kew, Richmond, Surrey TW9 3AE.

This update of the previous checklist published in 1988 has been made possible through the diligent work of Tom Preece, who is well known to Yorkshire mycologists. In all, 106 taxa are listed together with details of their hosts and county records (including many for Yorkshire). A most useful contribution to our mycological knowledge.

Fungi by **Roy Watling**. Pp. 96, illustrated in colour throughout. Life Series, The Natural History Museum, London. 2003. £9.95 paperback.

Roy Watling paints a delightful picture of these fascinating organisms, as would be expected of our local boy, who was not only born in Halifax but also maintains strong mycological links with the county. His latest book encapsulates the magic that he has conveyed to many of us in the field and laboratory and through his publications over many years. This clearly expressed text, complemented by magnificent illustrations, will provide a useful introduction to the general reader and a pleasure for the botanist.

MRDS

Conservation by **Clive Hambler.** Pp. x + 368, with numerous b/w plates, line drawings & tables. Cambridge University Press. 2004. £00.00 paperback.

This latest addition to CUP's *Studies in Biology* series provides not only substantial and essential background reading but also a refreshingly new approach to the subject. The volume is well produced, particularly in respect of visual material (although a few photographs lack clarity), and only a few errors have been noted in the text, e.g. Spanish moss (confused with reindeer moss, p. 51) is not a lichen, but a Bromeliad.

A wide range of key topics relating to threats to biodiversity, management and monitoring of species and habitats, sustainability, and environmental economics, law and education are covered, making it required reading for the natural historian. The book will also provide an important text for the undergraduate, although the index, by omitting names of organisms, key workers and locations, will hamper the reader. Nevertheless, strongly recommended.

MRDS

The Isle of Wight Flora by **Colin Pope**, **Lorna Snow** and **David Allen**. Pp. 255 (including numerous line drawings & maps), plus b/w frontispiece & 16 pp. of full colour illustrations. The Dovecote Press, Wimborne/Isle of Wight Natural History Society, Ventnor. 2003. £35.00 hardback (plus £5.00 postage & packing, from: The Dovecote Press Ltd., Stanbridge, Wimborne, Dorset BH21 4JD).

The British tradition of providing informative and useful guides to local floras on a county by county basis is maintained by this excellent addition which vividly portrays the uniqueness of this particular island's flora. Although the Isle of Wight is only 147 square miles, it supports a remarkably rich flora, not only of vascular plants, but also of bryophytes, lichens and stoneworts; these plants are enumerated in great detail, together with most helpful accounts of the geology, palaeoecology, topography, habitats and climate. There are further chapters on the distinctiveness of the island's flora (by Francis Rose) and on the botanists who have studied it over four centuries (by David Allen). The whole is supported by excellent illustrations in the form of photographs, many in colour, and 341 distribution maps for many of the vascular plants and bryophytes. This work will be of considerable interest and value to field botanists, and also prove to be extremely useful to those responsible for our natural heritage.

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Academia 350. Die Leopoldina-Feiern in Schweinfurt und Halle 2002 edited by **Benno Parthier.** *Nova Acta Leopoldina* **87**: 1-248 (2003). Available from Wissenschaflichen Verlagsgellschaft, Birkenwaldstrasse 44, 70191 Stuttgart, Germany. C 24.80 paperback.

This volume, celebrating the 350th anniversary of the Deutschen Akademie der Naturforscher Leopoldina in Schweinfurt in January 2002, covers a wide range of topics which reflect the pre-eminence of its past and present members in maintaining high standards in scientific studies. The papers are published in either German or English, the latter covering much of the workshop on Science and Society held in June 2002 which included interesting contributions on 'science advice, policy making and public trust', 'public understanding of science', 'scientists and science in the public eye', and 'science in search of its audience'. Such topics are strongly recommended to readers of *The Naturalist*: although the Yorkshire Naturalists' Union is less than half the age of the Leopoldina, it should reflect on how it can maintain standards and at the same time communicate natural history to a wider audience.

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THE BRITISH ALEURITIA PRIMROSES: THEIR HYPOTHETICAL ORIGINS, AND THEIR REDUCED CIRCUMSTANCES

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Introduction

Two species of Primrose assigned to the sub-genus *Aleuritia* (Duby) Wendelbo occur in the British Isles: Birds-eye Primrose (*Primula farinosa* L.) and Scottish Primrose (*P. scotica* Hook.). The former is the widest-ranging example of some half-dozen diploid species, with 2n = 18 chromosomes, which occur throughout the temperate regions of the northern hemisphere; the latter with 2n = 54 chromosomes exemplifies the several polyploid species that have extended the range of the sub-genus further north, and to higher altitudes.

This paper is unashamedly speculative, and only further chance discoveries of fossil *Primula* remains, and likely advances in understanding of *Aleuritia* genetics, may falsify or support the hypotheses advanced.

P. farinosa, with its restricted range in northern England, is part of a relict late-glacial flora and vegetation now largely obliterated from continental Europe, as described for Upper Teesdale by Bradshaw (1981). *P. scotica*, with an even more restricted range, in northern Scotland and Orkney, is endemic to the British Isles. A long-established general view of the origins of *P. scotica* is exemplified by that of Ford (1975) as "a homostyled 'species' evidently derived from the heterostyled *P. farinosa*". Although it is not possible to provide direct evidence on these evolutionary events, or to demonstrate the geographical history of either species with clarity, it is appropriate to produce hypothetical scenarios providing the simplest explanations for the known facts.

A comprehensive paper by Coles (1998) collates evidence from numerous disciplines to invoke 'Doggerland' a broad connexion between what is now Britain and the Continent, with a maximum extent in the Later Devensian/Weichselien ice–age (*c.*16 000 BP – *c.*10 000 BP) – 'a place to live' with a changing diversity of habitats for plants and animals – shrinking by early Holocene times to the 'land bridge' of more general perception. Later, changes in sea level left the 'Dogger Hills' as a temporary island – a forerunner of the submerged Dogger Bank in the North Sea. 'Doggerland, with its varied topography will have had a flora and fauna similar to those of the surrounding lands' (Coles 1999), and could thus have provided habitats for either or both primroses, as might the unglaciated part of Britain, south of 'Trafalgar Square' (latitude 51°30' N) – (see e.g. glaciation map in Bickmore *et al.* 1963: 19).

Questions and possible answers

"Are [the] polyploid Scottish and Scandinavian endemic Primulas of ancient lineage, nowadays surviving where they can find an ecological niche in areas dictated by the great ice flows, or did they evolve during the Quaternary Period from some simpler cytological type as a result of *violent selection pressure* [my italics] exerted by successive glaciations?" (Dovaston 1955).

The Quaternary Period?

Although it is probable that the genus *Primula* would have existed (as do many genera alive today), as far back as the Tertiary, there appears to be no evidence to suggest that the main period in the diversification of the *Aleuretia* was other than periglacial as suggested by Richards (2002) with reference to *P. scotica*. The earliest record of *P. scotica* is from an Upper Palaeolithic deposit as discussed below.

The chromosome complement

The Scandinavian species referred to by Dovaston is the octoploid *P. scandinavica* (2n = 72), which, like *P. scotica*, is a homostyled species not dependent entirely on insect pollen vectors. Like *P. scotica* it occupies a separate ecological niche to that of *P. farinosa*. Its latitudinal range overlaps that of *P. farinosa*, and like *P. scotica* it shows adaptation to high latitudes in its early-flowering response to increasing daylength, and in its, partial at least, independence from pollen vectors.

Possibly the most recently published suggestion as to the evolution of *P. scotica* is that of Richards (2002): it may be the outcome of hybridization between an octoploid like *P. scandinavica* and a tetraploid in the '*P. farinosa* complex' (with gametes n = 36 and n = 18 respectively). This neat numerical explanation, however, appears to reverse the general maxim of polyploidization ('the conversion . . . of cells or individuals from a haploid or diploid state to a polyploid state' (Rieger *et al.* 1968), that numbers go only in one direction – upwards. Further, regularity in gamete production, and sexual fecundity, would not be entirely expected in plants derived from such a union.

Numerical constancy of the chromosome complement of *P. scotica* is a presumed characteristic (counts were reported by Bruun (1932) without comment), and no evidence of gross impairment of viable pollen production, or of viable seed production, was reported by Tremayne and Richards (2000). Regular and accurate pairing of homologous chromosomes in an F1 hybrid would not be likely, and only by virtue of a pre-adaptive mutation for 'multivalent suppression' (found so far in only a few plant species) could a semblance of regular meiosis take place to produce the n = 27 gametes characteristic of the evolving species. *P. farinosa* has been recorded from the islands of Öland and Gotland which emerged from the Baltic sea during deglaciation (Bennet 1995), but doubt has been cast on the reported existence of an autotetraploid population on Gotland (Hambler 2003), and the unlikelihood of this, together with perhaps a Scandinavian octoploid being ancestral to *P. scotica* is evident.

An alternative, more likely, origin was suggested, on evidence from hybridization experiments (*P. farinosa* x *P. scotica*), by Arnold and Richards (1998): the 2n = 54 complement of *P. scotica* might have arisen through a triploid ancestry, that is, from chromosome doubling in a 'presumably sterile triploid cross between a pin and a homostyle species'. A mode of origin for a meotically competent *P. scotica*, not inconsistent with this view, is suggested in Table 1. It neccessitates three 2n = 18 ancestral cytotypes (all *P. farinosa* sens.lat.?) with chromosomes differing structurally (a result of a period of mutual isolation, and evolution through selection and genetic drift). The first 2n = 54 '*P. scotica* cell' could have comprised part of a chimera. Its chromosome complement might be represented thus: **BBCCDD** – each letter representing a unique haploid set of 9 chromosomes. Germ-line descendents of such a cell would through regular meiosis produce normal gametes BCD. The original hexaploid cell would have constituted a genetic bottleneck, this being consistent with the low genetic diversity in *P. scotica* found through isozyme analysis by Glover and Abbott (1995). It is evident that only two distinct failures of cell division, each isolated in time and space are required for this model. Although the focus here is on one ancestral cell, its production would have been just one incident related to many separations, migrations and introgressions of *Primula* populations – all consequences of the environmental disturbances invoked by Dovaston (above).

Reproduction and tolerances

How might a new species escape through the genetic bottleneck? As Stebbins (1950) pointed out, polyploidy can arise and become established more easily in perennial herbs which are hemicryptophytes (or in perennials that have efficient means of asexual reproduction) than in annuals. A founder genet with the relevant characteristics has the immediate advantage of possible longevity, allowing seed production over a number of years.

Further, such plants (which are in exceptionally high percentage in high northern

TABLE 1.
Outline of a possible origin for the hexaploid chromosome complement of *Primula scotica* (2n = 54). Each capital letter represents a set of nine chromosomes (somatic complements in bold capitals; gametic complements in italics).

EVENT(S)	CYTOTYPES	RESULT
	AA	A Pre-Pleistocene diploid heterostyle aleuretian ancestor (2x = 2n = 18).
Isolation of populations (in glacial refuges?)	.	Evolution of structural cytotypes.
	BB CC DD	Cytotypes potentially interfertile.
Isolation lost (as ice retreats?). Gametes of two cytotypes meet.	**BC**	Diploid hybrid, not sexually fully competent, producing some faulty gametes, including some with 18 chromosomes.
Faulty 2x (♀) gamete: produced. A (♂) gamete of the third cytotype contributes another set after pollination to give:	*BC*	
	BCD	Triploid 3x = 27 hybrid: meiosis so iregular that functional gamets cannot be produced.
Genet (clone) survives long enough for a failed cell division at a stem apex to produce :	**BBCCDD**	The first hexaploid (3x = 54 cell).
Hexaploid cells form part, or all, of an inflorescence. Fairly accurate chromosome pairing at meiosis now possible to produce:	*BCD*	Functional (2n = 3x = 27) gametes are produced each spring/ summer.Homostyly is a genetic 'by-product' of polyploidization.
Self pollination and ensuing fertilization, is possible to produce:	**BBCCDD**	The first independent self-fertile hexaploid genet(s): (2n = 54).

latitudes) appear better equipped, than annuals, to take advantage of a greater range of tolerance of climatic extremes. The presumedly archetypal hemicryptophyte *P. farinosa* is so equipped: its genets (plant(s) derived from a single seed), although not a means of distribution, or of rapid spread, are capable of surviving for many years, (Bradshaw 1983). They endure the winter as bulb-like ramets (Fig. 1) buried amongst leaf litter, or sometimes completely exposed through erosion. These general attributes of *Aleuritia* would enhance the survivability of relatively infertile hybrid products of introgression, and, when inherited by a single sexually fertile polyploid plant, could allow it several years of seed production as the founder of a species. Surprisingly, year-to-year vegetative persistence seems less likely in *P. scotica* than in *P. farinosa*.

P. scotica, like *P. farinosa*, is a hemicryptophyte: 'plants' have been shown to be capable of surviving in its natural habitat, at latitudes higher than 58°N for more than fourteen years by Bullard *et al.* (1987), but in a direct comparison with *P. farinosa* at a lower latitude – 53°47' N° (Bradford) – it has proved less vegetatively persistent. The species have been grown together, from seed, in 25 cm. diameter pots outdoors, in peat-based

compost with a mulch of limestone chips, since 1999. *P. farinosa* has so far (in 2004) continued its vegetative expansion, and has continued to flower copiously each spring and summer. Athough the cohort of 30 genets had declined to 21 by the summer of 2004, it produced, in that year, a total of 454 flowers (borne on 73 scapes). The *P. scotica* cohort (also initiated as 30 seedlings) flowered for only three, years, and in 2004, although 14 genets remained, it produced only a single, two-flowered inflorescence.

Dispersal, ecology and geography

Neither species has a means of vegetative dispersal, but over a period of years a *P. farinosa* genet may produce numerous ramets; for example the modal (net-) number of the cultivated cohort was five in October 2001). Ramets may remain conjoined by their dead stem axes in drier conditions, but may become separated through rotting of these axes in moist soil (Fig. 1). Each ramet has the potential to give rise to at least one inflorescence. The relatively truncated flowering-life of *P. scotica* 'plants' in cultivation, noted also by Richards (2002), is associated with minimal ramet production (a modal net number of one surviving ramet per genet/ year in cultivation seems usual), and Bullard *et al.* (1987) refer only to 'rosettes' in their demographic report

P. scotica is adapted to conditions at higher latitudes than *P. farinosa*, yet mortality in nature in Orkney was shown to be reduced in a period of mild winters by Bullard *et al.* (1987); they also showed that the number of days per year with gales, and to a lesser extent January mean minimum temperature, were positively correlated with mortality. These authors postulate that population maintenance in this relict species now requires considerable habitat stability; thus the selection pressures now operative must be regarded as even more 'violent', than those which Dovaston (1955) proposed to account for its evolution. *P. scotica* is at an evolutionary, and territorial, dead end'!

Both primroses produce large numbers of very small (<1 mm diam.) seeds capable of being dispersed through the agencies of wind and moving fresh water. The smaller seeds of *P. scotica* (Fig. 2) are produced in greater numbers per capsule than those of *P. farinosa*, yet a genet of the latter has a potential for producing more flowers at any one time, and may flower for a greater number of years. Ultimately, the range of each species has been influenced by the production and dispersal of its seeds, as well as by the availability of ecologically appropriate sites.

The range of *P. farinosa* (Fig. 4) suggests that its populations on the continental mainland (where it undoubtedly evolved) and in Britain were once contiguous; it extended northwards as far as lowland Scotland (56°N) until recent times (see Preston *et al.* 2002). In Scotland it is excluded from the range of *P. scotica*, just as in Scandinavia it is excluded from the mountain habitats of *P. scandinavica*. The present disjunct nature of its distribution is contingent not only upon the advent of barriers to dispersal, such as the English Channel, but also to reduction in the extent of grazed grassland habitats and calcareous mires through forest development and to human interference.

The present restricted range of *P. scotica* (Fig. 4) is more problematic. As Dovaston (1955) pointed out, it is unlikely to have survived glaciations in its present locations because the last ice cap extended well to the south of its present range. Further, exposure to 'arctic' weather, even within its present range, seems detrimental: the net growth of a population has been shown to be increased in a period of minimal snowfall and warm

FIGURE 1. (opposite)

The archaetypal hemicryptophytic habit of the Primroses. (a) A four year old pot-grown genet of *Primula farinosa* in January showing the bulb-like shoots of physically independent ramets freed from leaf litter and growing-medium by means of a water-jet. (b) A genet of the same species, in the wild, on a vertical cliff with *Sesleria albicans*: March (Wharfedale, Yorkshire). The living shoots are buried in litter (including self-generated silvery dead leaves); old roots are exposed; dead shoot axes may be present.

1cm

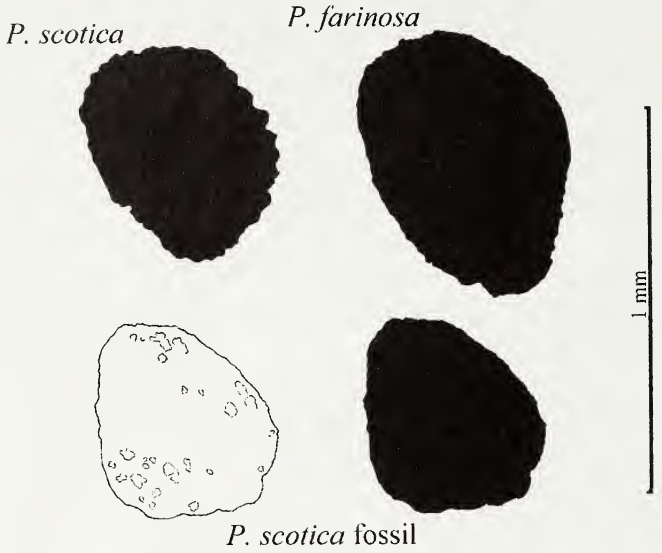

FIGURE 2.
Seeds of *Primula farinosa* and *P. scotica*.

January temperatures, and the positive 'killing power' of gale-days/year has been demonstrated by Bullard *et al.* (1987).

At the last full glacial maximum (Devensian/Weichselian) Britain would have been connected to the Continent along a broad area from eastern Scotland round to southwestern England, and the channels separating Orkney from Scotland would not have been flooded (see Bennet 1995, Coles 1998). Here, in Doggerland, and in 'Britain' conditions, at various places and times, congenial to *P. farinosa* may be envisaged. There would, as the British and Scandinavian ice sheets began to waste, in the Late Glacial period of slow warming, have been a relatively bare landscape bordering the ice in Britain. Pioneer grazed vegetation would have existed, in which gap colonists such as *Primula* species might survive in the absence of overwhelming competition – possibly on a greater range of soils than their present distributions might suggest. There is no evidence, however, of their co-existence in any place, or at any time.

The retreat of ice sheets in Scandinavia and Britain, and development, in the Later Holocene of the English Channel, are illustrated in a series of maps devised by B. J. Coles and S. E. Rouillard (Coles 1998) based on collation of evidence from a multiplicity of disciplines. There is evidence trawled from the bed of the North Sea (Stewart 1995) of a period of unimpeded immigration of both plants and large animals (including mammoth, woolly rhinoceros reindeer and *Homo sapiens*) throughout the last ice-age, i.e. between 75,000-10,000 years BP (Sutcliffe 1995), until the English Channel was established around 8 300 BP. However, *Primula* pollen turns up so rarely on pollen diagrams that line of evidence for its former distribution is virtually non-existant (M. Atherden *pers. comm.*). A hypothetical reconstruction of an Earlier Holocene coastline is illustrated by Figure 3 (from Coles 2000): the relict 'land bridge' represents the last opportunity for overland transport of seed-plants between Britain and the continental mainland.

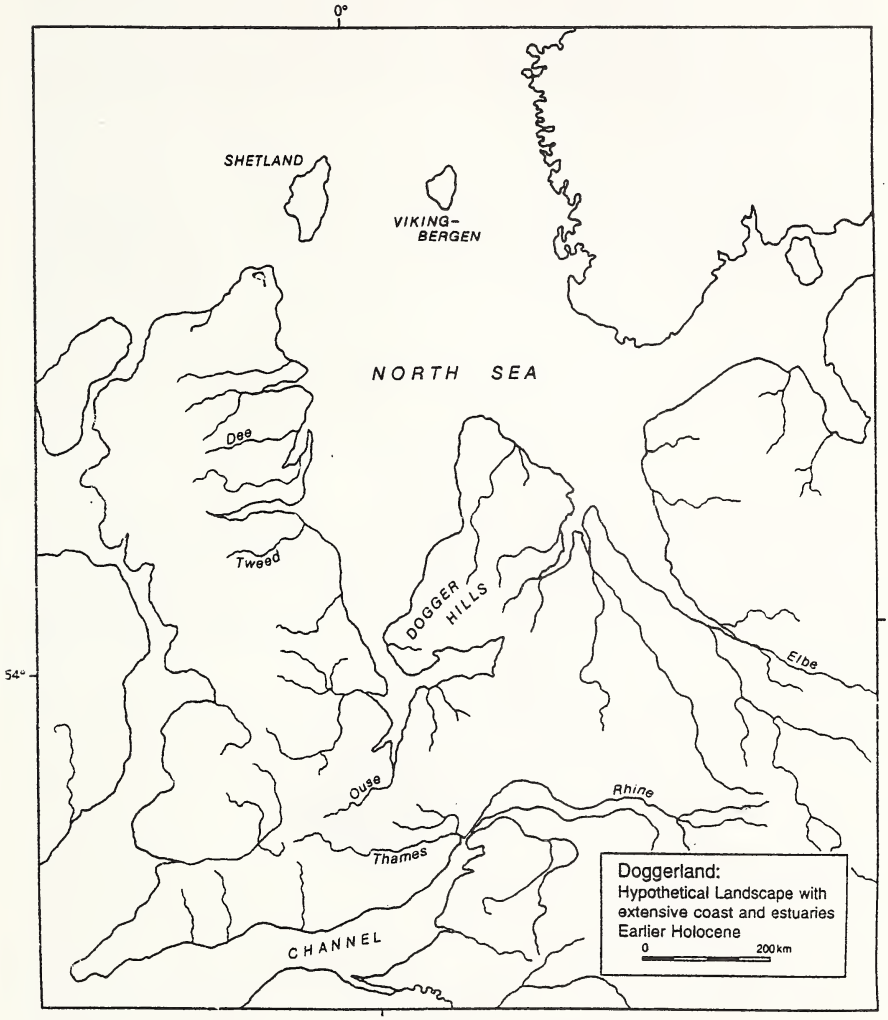

FIGURE 3.
The Continent, the British mainland and Orkney conjoined
(from Coles 2000 with permission).

Fossil evidence

P. scotica has not been found on The Continent, but evidence exists of its one-time presence near the British 'end' of the Earlier Holocene land-bridge. A single fossil seed was found in a peaty seam of Upper Paleolithic gravels at Barnwell, Cambridge (Chandler 1921). There can be little doubt that her identificaion was correct: Dovaston concurred with this determination, after comparing it with arange of authenticated seeds, and my own photomicrographs of this grey-black fossil show that its dimensions and the unicellular bulges of its testa match closely those of 'modern' *P. scotica*. Seeds of both species are illustrated in Figure 2.

Conclusions and Discussion

It seems that *P. scotica,* like many other polyploid species, including *P. scandinavica*, can only be the evolutionary product of a series of stochastic events including isolations, miscegenations and accidents in cell division (none particularly unusual in plants). The concept of 'violent selection pressures' quoted above might be modified through the

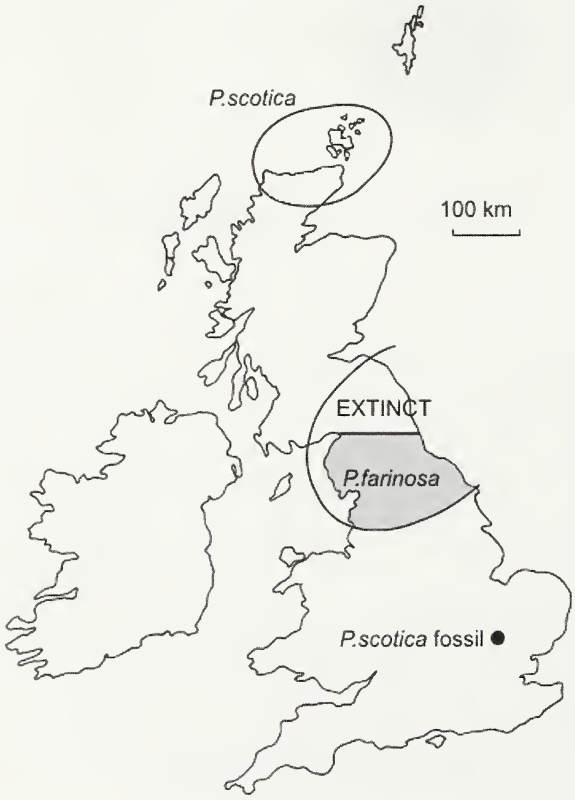

Figure 4.

The British ranges of *Primula farinosa,* and *P. scotica* in the 20th century (for details see Preston *et al*. 2002). The former was exterminated during the 20th century north of the line at 55°N across its historic range; the latter is not now present, in nature, outside Scotland.

(paradoxical) suggestion that in periglacial times repeated landscape modification resulted in production of new 'open' habitats; these provided *opportunities for survival* of potential 'new'species, and for the periods of genetic isolation required for their establishment. Violent selection pressures could thus have eliminated many evolutionary 'experiments' among the aleuritian primroses, whilst the evolutionary line to *P. scotica* was favoured.

Two polyploid primroses, *P. scotica* (2n = 54) and *P. scandinavica* (2n = 72), could each have existed at the same latitude as *P. farinosa*, and far south of their present ranges on the Continent (the former even in the unglaciated south of England!) during and after the last glaciation. It seems likely, however, that the polyploid stocks evolved separately near the western limits of the Continent – perhaps even in Doggerland. Each proved better adapted than *P. farinosa* to relatively pollinator-poor locations around the glacial margins, and, possibly later, to shorter favourable seasons; they were destined to move northwards along different tracks. It is relevant to note that other British species found by Chandler in the Barnwell deposits, and now entirely, or largely, confined to Scotland (*Salix lapponicum, S. herbacea, Thalictrum alpinum*), may have a similar history of migration northward in Britain. Migration of any such species from north to south immediately after glaciation seems *ipso facto* unlikely.

The single authenticated fossil seed from Barnwell is evidence enough to suggest that the Scottish Primrose may have evolved, in the wake of retreating ice, far from Scotland, and that it was probably (locally at least) abundant for a while around the higher reaches of the River Cam – suggestively adjacent to the land bridge of Figure 3 – before Britain became isolated about 8 300 years ago.

Acknowledgements

I am grateful to Mike Dawling of the Sedgewick Museum, Cambridge who kindly allowed me access to the fossil seed and to Louise Brown, University of Bradford, who based the interpretative drawing of the seed's surface on my photomicrographs and also delineated Figure 4. Permission to reproduce the map (Figure 3) was given by Bryony Coles of Exeter University and the recent *Primula scotica* seed (Figure 2) originated from the Royal Botanic Garden, Edinburgh.

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BOOK REVIEW

The Return of the Unicorns. The natural history and conservation of the Greater One-horned Rhinoceros. By Eric Dinerstein. Columbia University Press, New York. 2003. Price £36.00 hardback.

The conservation of any animal or plant has effects well beyond the confines of the individual species. These effects are even greater, however, when an animal weighs up to 2.2 tonnes, can travel up to 6 kilometres in a single day and has an annual mean home range of 4.3 square kilometres. The animal in this case is the Indian or Greater One-horned Rhinoceros, *Rhinoceros unicornis*, the Latin name of which is the basis for the title of the book. This book is the culmination of the work of the author and his many associates on a detailed study of the One-horned Rhinoceros in the Chitwan National Park in Nepal, but it also includes comparative information on other locations, as well as the other species of Rhinoceros found in Asia and Africa.

In 1966 the world population of this animal was estimated at 740 individuals: 575 in India and 165 in Nepal. The author states that in 1972 the Chitwan area of Nepal had about 100 animals left. The establishment of the Chitwan National Park and the co-operation of the local people, who have to share the land with the Rhinoceros, has enabled the establishment of a population of up to some 600 individual animals. This co-operation included giving up some 30 square kilometres of farmland to turn it back into a forested buffer zone. This has improved the situation not only for the Rhinoceros, but also for the Bengal Tiger and some 191 bird species as well as countless other animals and plants. The best measure of the success of the conservation programme is, perhaps the economic benefit it has also brought to the local human population.

Although some of the chapters are very dry and technical, on the whole, this book shows how closer co-operation among organisations and various authorities can bring success; something we in Britain could learn to the benefit of our flora and fauna.

AN

THE SLOW RECOVERY OF ERODED BLANKET-BOG VEGETATION IN THE PEAK DISTRICT

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The pressures acting to erode blanket-bog vegetation were evaluated for "The Moorland Erosion Project" (Phillips *et al.* 1981) by John Tallis, who drew attention to the complex historical sequence that resulted in bare peat, and the major factors that hindered revegetation (Tallis 1981). These factors included grazing, the instability of the deep peat which supported this vegetation and its infertility, lack of seed sources, unfavourable microclimate (both frost-heave in winter and desiccation followed by wind-deflation in dry summers), and pollution.

Of these factors, air pollution cannot be readily manipulated at a local scale. Microclimate can be modified through use of various stabilisers, such as larch brashings and oil-based emulsions. Seed sources can be added, as in the 5 sets of experimental plots set up in 1980 (Tallis & Yalden 1983). However, the major and most immediately effected change, used in all these plots, was to exclude sheep, thereby preventing both grazing and trampling damage. The relative effects of these changes were evaluated by Tallis and Yalden (1983), for what by then had been renamed "The Moorland Restoration Project". Given a reasonably stable mineral soil, the combination of excluding sheep and applying heather seed gave encouraging levels of revegetation within three years. Deep peat proved more refractory, but further trials using in addition lime and fertiliser achieved some success, as in some of the later trials at Holme Moss reported in the final report of the project (Anderson 1997). A nurse crop of "exotic" (to the location) grasses, and the stabiliser *Geojute*, were also effective in some of those later trials (Anderson 1997).

In one additional 1980 plot, at Doctor's Gate (SK096933), a section of eroded blanket-bog, near the downhill edge of the peat cover, was fenced to exclude sheep, but no other treatment was or has been undertaken. The intention was to study the natural recovery of the vegetation cover. The slowness of this recovery is documented here.

Methods

The exclosure at Doctor's Gate, measuring a nominal 20 x 30 m (in practice about 20.4 x 30.6 m), was set up in spring 1980. It has been monitored by mapping the vegetation at irregular intervals in relation to a grid of canes at 2 m x 2 m intervals. The vegetation at the position of each cane has been scored as a point quadrat, giving a simple quantification of the spread of vegetation. A main drainage line across bare peat enters the north-western edge of the exclosure, and bifurcates to run down the eastern and western edges (see the photograph, Plate 9, in Tallis & Yalden 1983, taken from the north-western edge). This has influenced the type and speed of revegetation. In addition, a linear peat hagg down the eastern side, and a higher "peninsula" of peat in the south, are prominent features in the maps.

Results

When first mapped, in July 1980, the exclosure was 52% bare peat (Table 1). Mat Grass *Nardus stricta* provided most (31%) of the vegetation cover, especially on the eastern side above the peat hagg (Fig. 1, N, and see Tallis & Yalden 1983: 32-35). The exclosure was mapped again in August 1982. Expansion of wetter "islands" of Common Cotton-grass *Eriophorum angustifolium* (Fig. 1, A) was among the most noticeable of the modest changes, and bare peat had declined slightly to 47%. Heavy flowering of Wavy Hair-grass *Deschampsia flexuosa* in the first summer after fencing was also noted, and a heavy crop of young seedlings was recorded in autumn 1980. However, these were mostly on the steep peat below the eastern peat hagg and survival over their first winter was no more than

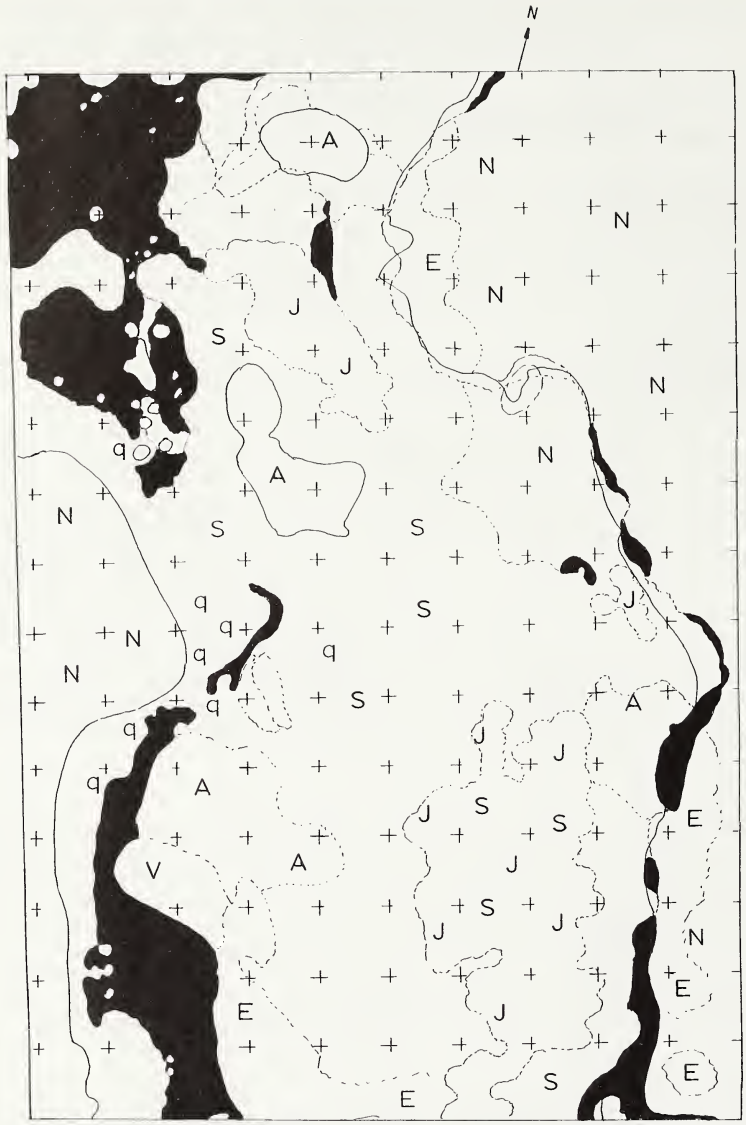

FIGURE 1.

Doctor's Gate Exclosure. Simplified vegetation map, 2004. The two former (1980) islands of Common Cotton-grass (A) towards the north of the exclosure and the peninsula of Bilberry (V) in the south are identified, along with areas of Mat Grass (N) (*cf.* Fig. 2). Expanses of Soft Rush (J), in places overlying *Sphagnum* (S) are also identified, as are patches of Crowberry (E). Areas where Heath Rush is prominent are marked q, but many isolated clumps of rush (both species) dot the exclosure. Black indicates the bare peat remaining in 2004. The grid of point quadrats at 2 m intervals gives the scale.

FIGURE 2.
Doctor's Gate Exclosure. Changes in bare peat, 1980-2004. Coarse stipple and the fine line indicate the boundary of vegetated areas in 1980. The dashed line and fine stipple show the modest expansion to 1982. The edge of vegetation in 1990 is marked by the dotted line, and bare peat remaining in 2004 is black. Areas of regression are indicated in horizontal shading, the darkest being areas which are bare in 2004.

Table 1.
Doctor's Gate exclosure. Percentage vegetation cover, assessed from point quadrats at 2 x 2 m intersections (n = 165 points).

	1980	1982	1990	2004
Bare Peat	51.5	46.1	26.7	10.2
Common Cotton-grass	2.4	5.4	11.5	10.8
Mat Grass	30.9	29.1	21.2	30.1
Bilberry	1.2	1.2	1.2	2.8
Crowberry	4.8	5.4	6.1	6.8
Soft Rush	1.8	3.6	7.3	6.8
Heath Rush	–	–	3.0	7.4
Bog-moss	–	–	1.2	11.9
Wavy Hair-grass	6.7	8.4	18.5	7.4
Other			3.0	6.8

0.4%. Numerous seedlings of Heath Rush *Juncus squarrosus* were also noted, particularly in the centre of the exclosure, and slumping of the eastern hagg wall produced some detached fragments of turf, mostly *Deschampsia* and *Nardus*, that seemed likely to survive (Tallis & Yalden 1983).

By the time of the last report, produced after another name change by "The Moorland Management Project", the exclosure had been mapped once more, in 1990 (Anderson *et al.* 1997: 10-13). By this time, bare peat had declined by about half, to 27%. Mat Grass still provided the largest amount of vegetation cover, but Wavy Hair-grass, Soft Rush *Juncus effusus* and Common Cotton-grass had all expanded appreciably (Table 1).

In winter 2003-2004, much of the Bleaklow plateau was fenced to exclude sheep entirely, prior to substantial revegetation work on large areas of eroding peat. The Doctor's Gate exclosure is within this much larger fence-line, and it seemed appropriate to map it once again in April 2004, prior to removing the now redundant exclosure. After 24 years, the area of bare ground has reduced to 10% (Table 1). The eastern half of the exclosure is now almost entirely vegetated, with only remnants of bare peat along the former hagg line. Bare peat in the gulley in the western section is divided into a northern and a southern part, with a band of Crowberry *Empetrum nigrum* and Mat Grass dividing them (Fig. 2). The most dramatic change has been the extensive carpet of bog-moss *Sphagnum recurvum* which underlies much of the Soft Rush and occupies the centre of the exclosure. Mat Grass appears to be more extensive than in 1990, but this may be an artifact of a late winter (April) survey; other grasses are then much less evident than in July-August. Heath Rush *Juncus squarrosus* is now very evident as a component of the vegetation, especially across the central-western side, where it seems to have successfully colonised the hard bare wet peat flats that once occupied this section. Overall, the vegetation seems more diverse than formerly, and the bryophyte community (not just *Sphagnum*, but *Polytrichum* and *Drepanocladus*) is much more evident.

Discussion

After 24 years, this area is still 10% bare. In particular, the steep slopes below the Bilberry-topped peninsula in the south-west corner of the exclosure (Fig. 1, V), and the area in the north-west corner which receives most influx of water during rainfall, are still bare. Most of the eastern side, by contrast, is now vegetated, the former gulley filled by a dense Soft Rush community with a carpet of underlying *Sphagnum*. It seems likely that trampling is especially damaging to bryophytes. Yalden (1981: 139) remarked on the sharp effectiveness of sheep's hooves in cutting into peat, and the greater pressure they exert than a human footfall. It is very evident that this continued pressure on the area immediately outside the exclosure has severely cut the ground away from corner posts and stiles, so that

Mountain Hares can readily enter the exclosure now (and sheep have done so occasionally in the past decade). Clearly, the deep peat on these moorlands is readily damaged, and damage is best avoided. When catastrophic fires or floods do damage an area, removing the grazing and trampling pressure from sheep during the first years of recovery is essential. Even then, recovery is slow. Despite its protection, the bare peat in this exclosure has diminished over 24 years at only 1.7% per annum.

Acknowledgments

The companionship and support of my colleagues on the Study Team of The Moorland Erosion (later, Restoration, then Management) Project, especially John Tallis, Penny Anderson and John Phillips, is much appreciated. John Tallis, specifically, mapped and remapped the Doctor's Gate exclosure with me in 1982 and 1990, and my wife helped with the original mapping in 1980. The Steering Group, including Ken Parker of the Peak Park and David Wilson of the National Trust, directed and supported this work, including getting the fence erected and allowing it on National Trust land.

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BOOK REVIEWS: BRITISH GEOLOGICAL SURVEY PUBLICATIONS

Geology of the Ringwood District: a brief explanation of the geological map sheet 314 Ringwood by **C. M. Barton** *et al.* 2003. 34 pp. ISBN 0852724640. £9.00.
Geology of the Winchester District: sheet explanation and 1:50000 S & D map E299 by **K. Booth.** 2002. 34 pp. ISBN 0852724292. £9.00.
Geology of the Glen Shee District: memoir for sheet S56W by **A. Crane** *et al.* 2003. 117 pp. ISBN 0118845462. £35.00.
Cainozoic Geology and Landscape Evolution of North-east Scotland by **J. W. Merritt** *et al.* 2003 178 pp, plus CD Rom of Appendices. ISBN 0852724632. £35.00.
Geology of the Ballater District: memoir for sheet S65E by **C. G. Smith** *et al.* 120 pp. 2003. ISBN 0118845632. £35.00.
Pwllheli: memoir for sheet E134 by **T. P. Young.** 130 pp. 2002. ISBN 0118845616. £35.00.

These publications cover a wide range of topics outlining the physical characteristics, distribution and origin of deposits, many providing a sound background to the geological, geomorphological, climatic and botanical changes that have occurred through time in a

selected landscape. This level of information will be useful for civil engineers, planners, botanists and those concerned with managing the natural environment and its resources.

A number of these new publications also integrate offshore and onshore data in terms of stratigraphy and attempt to provide accounts that can form the basis for future research projects/activities.

The memoir that describes the *Geology of the Ballater District* covers the impressively mountainous country between upper Deeside and upper Glen Clova in north-east Scotland. The large upstanding granitic intrusion of Lochnagar, beloved by climbers and walkers (and Lord Byron) dominates the area. The memoir describes the complex nature of the igneous, metamorphic and erosional processes which have produced today's landscape. The memoir that describes the *Geology of the Glen Shee District* covers an area that straddles the Highland Boundary Fault Zone, which forms the regional boundary between the Late Proterozoic Dalradian Supergroup of the Southern Highlands and the Silurian rocks of the Midland Valley. Four phases of regional deformation affected these rocks, mainly attributable to the Grampian Orogeny. Where the *Geology of the Winchester District* is concerned, the area described lies within the Wessex Basin in the south of England, and is an area of classic chalk downland – the Cretaceous Chalk Group is the oldest rock at surface in the district. All the above provide fairly comprehensive and easy to read detailed descriptions of their selected areas.

Pwlheli Memoir for sheet E134, which covers the central area of the Llyn Peninsula in north-west Wales, with the Harlech Dome to the east and the mountains of Snowdonia to the north-east, contains a wealth of new stratigraphical, palaeontological, petrographical, geochemical and geomorphological information, and a new centre of volcanicity is identified. There is a detailed chapter on the Quaternary geology, with the glacial deposits around Glanllynnau described as one of the most intensively studied glacial sites in the world. It is well illustrated and it is good to see photographs of macrofauna and microflora of the Cambrian rocks of St Tudwal's Peninsula; thin section photomicrographs, for example the glomeroporphyritic cluster of andesine and augitic clinopyroxene within the Bryn Crin Basaltic Trachyandesite (Plate 18, page 65), are also very welcome. In parts there is perhaps too much detail for the average reader: although this is laudable in the reviewer's opinion, if this series is also destined for use by the amateur geologist, as suggested in the Preface, then perhaps Chapter 6 on igneous geochemistry might have been more appropriate as a book chapter or even scientific paper. The Quaternary section is well presented and illustrated, particularly in the use of seismic reflection data (see Figure 49, p. 107). There is a good level of detail once again. Overall this publication represents good value for money for the information available.

Some of the guides reviewed here did not represent such good value for money as others, being generally less well illustrated (although still to a fair standard) and containing far less information. There are two price levels: *Geology of the Ringwood District,* for example, costs £9 and is 34 pages long, while the *Cainozoic Geology and Landscape Evolution of North-east Scotland* costs £35, is 178 pages plus a CD and is very good value considering the amount of information it contains. Although the inclusion of a CD with Appendices should be applauded, it is rather cumbersome to have to use this to access information, such as site descriptions, that should be more readily available within the printed volume. In some publications I would have liked to have seen more detailed discussions rather than fairly cursory comments (e.g. on tsunami deposits in Merritt *et al.* 2003), but generally speaking, coverage in most of these publications is quite comprehensive.

Overall, the British Geological Survey publications reviewed above are of a very high standard, in terms of both content and production quality.

GKG

YORKSHIRE NATURALISTS' UNION EXCURSIONS IN 2002

Compiled by
A. HENDERSON and JANETTA LAMBERT

RIPLEY PARK ESTATE (VC64), 24-25 May 2002

INTRODUCTION (J. A. Newbould & C. A. Howes)

Ripley Park is situated north of the flood plain of the river Nidd, four miles north of Harrogate, in an area which has seen the development of other parkland estates such as the nearby Nidd Hall, Fountains Abbey and Studley Royal parks. Ripley Park is situated at the southern end of the Dales Fringes Natural Area, much of it at only 50 m AOD. Two characteristic features of the area are the alder-lined River Nidd, oaks, probably around 200 years old scattered across the park, and the neatly trimmed hawthorn hedges along the roads.

The landscape is dominated by efficiency-driven agriculture, both pastoral and arable, commercial forestry, highways, managed artificial parkland and the demands of game rearing; the most significant ecological feature of the area is the survival of ancient woodland fragments and the presence of venerable trees (mature, over-mature and ancient coppice and pollard). A study of these and associated historic hedgerows would certainly be worthwhile.

Twenty-two members and guests attended on the Friday, and 23 on the Saturday. Despite an ominous weather forecast, on Friday there was sun all day with temperatures up to 15°C, whilst on Saturday winds gusted to force 5 with some intermittent heavy showers in the afternoon.

VERTEBRATES (C. A. Howes)

Bats recorded from the estate include Whiskered, Brandt's, Daubenton's, Pipistrelle (s.l.), Brown Long-eared and Noctule. From the 1870s to the 1890s the Lesser Horseshoe Bat was present in the Nidd Valley region.

Hedgehog, Rabbit and Brown Rat were recorded as road casualties on the busy A61. Molehills were in roadside verges and pastures. A Common Shrew's nest had been constructed under a demolished highways sign. Wood Mouse burrows and trackways were in hedge banks. Brown Rat had been attracted to pheasant feeding points where traps had been set. Roe and larger deer slots were in local woodland.

Ripley Castle and the Ingilby family have a particularly long history, as have the area's deer, Sir Thomas being granted (along with his knighthood) the right of free warren by a grateful Edward III. In 1938 under the ownership of Lt. Col. Sir William H. Ingilby the herd, confined to 15 acres of the estate, consisted of 7 fallow bucks and 53 does, but during the winter of 1939-40, disaster struck when 75% of the herd was drowned falling through the ice on the lake. In 1949, the herd consisted of just 1 buck and 7 does, but today the population has increased to 130 head.

There is a 1971 road casualty Badger record for Ripley. Old setts are found on the estate at Cayton Gill, Kettlespring and in woodland to the south west of the park, but current occupancy was not confirmed during our visit. Fox, a cause of sett gassing and blocking in the past decades, was noticed on the estate. Although a large female otter was caught in the nearby Nidd in 1884, no signs of either otter or mink were seen on this occasion. Alluding to the formerly thick afforestation of the Ingilby lands (1613-1863), *The History of the Forest of Knaresborough* (1871) quotes the traditional claim that a squirrel could pass from Padside Hall to Ripley Castle without setting foot on the ground. Since Grey Squirrels were not introduced into the Dales (Bedale) until 1913, the squirrel in question would have been the native red. One of the last naturalists to see Red Squirrel at Ripley was Eric Thompson in 1996 (*Naturalist* **91**: 10-14). Grey Squirrel was the only species noted on this occasion. The only amphibian noted was a common frog.

ORNITHOLOGY (Helen Jackson)
The weather, particularly on Friday, was not ideal for picking up song in woodland. The 51 species listed were typical of parkland, woodland, gardens, open fields, lakes and ponds. A hundred geese (Canada and Greylag in a ratio of ten to one), Tufted and Ruddy Ducks, and eight Shelducks were seen on the lakes. Broods of up to six Mallard were much more widespread near Alicia Wood and close to the eastern edge of the parish. Several Herons were seen.

Blackcaps and Willow Warblers were in evidence near High Rails Wood and in Cayton Gill, with Chiffchaff heard briefly. Swifts, Swallow and House Martin, but not Sand Martin, were recorded. Nuthatch in the Woodland Garden and Grey Wagtail below the cascade were in traditional sites. Of the waders, Curlews and an Oyster Catcher were reported and four Lapwings were in suitable breeding territory. Red-legged Partridge was heard on occasion, and Spotted Flycatcher was noted at the Castle.

LEPIDOPTERA (H. E. Beaumont)
Friday was showery with sunny periods, and a fresh wind which hampered recording. During the brighter spells, eight species of butterfly were recorded: Large, Small and Green-veined Whites, both sexes of Orange-tip, Peacock, Small Copper and Wall. Twenty mostly common and widespread species of moths were noted, either adult or immature. A single *Eupithecia tantillaria* (Dwarf Pug) was flying amongst spruce in Alicia Wood. Among the smaller moths *Hysterophora maculosana* was seen over bluebells in Cayton Gill Wood and two *Capua vulgana* were disturbed from the shrub layer in Lodge Hill Wood. The latter occurs widely and commonly in woodland in the south of VC63, but seems to be surprisingly scarce elsewhere in Yorkshire.

DIPTERA (A. Grayson)
Although cold, strong winds were relentless, it was warm in sunny sheltered areas where flying insects were concentrated. Most of the area visited was parkland, farmland, or woodland, with access difficult at times due to a proliferation of barbed wire and locked gates. From a dipterist's point of view the most interesting habitats were the alder carr beside the stream in the Cayton Gill area, Alicia Wood, and High Rails Wood, with various trees with rot-holes and sap-runs. Diptera recorded included *Rhagio scolopacea, Beris chalybata, Empis tessellata, Cheilosia variabilis, Eristalis pertinax, E. tenax, Rhingia campestris, Syritta pipiens, Xylota segnis, Mesembrina meridiana* and *Gymnocheta viridis*. The more local species recorded were *Xylophagus ater* from a tree trunk on Hollybank Lane, *Ferdinandea cuprea* in Alicia Wood, and *Merodon equestris* (not exactly local, but infrequently found) near Ripley Castle.

PLANT GALLS (K. G. Payne)
Unless otherwise indicated the following galls were collected by Joyce Payne. Most interesting were those of the fungus *Taphrina padi* and of the sawfly *Euura amorinae*: the former, causing elongated and distorted fruits in *Prunus padus*, has been little recorded; the latter shows as a stem swelling on *Salix* species, especially on *S. pentandra* on which it was collected and determined by Tim Flint. The galls of 12 other species were collected and included in a list sent to the YNU and the British Plant Gall Society recorders. Among them were eight common mite galls, including *Phytoptus padi* collected by John Newbould, and the Actinomycete gall, *Frankia alni*, collected by Janetta Lambert from roots of *Alnus glutinosa*.

BOTANY (P. P. Abbott)
In the immediate vicinity of the castle a walnut tree was in flower. In the children's activity area *Lilium martagon* was naturalised near a large cedar used for climbing, and there was a patch of *Lathraea squamaria* beneath a laurel. *Equisetum telmateia* was found near the ha-ha.

No submerged aquatics were noticed in either lake, probably due to the abundance of geese and ducks, but marginal plants included *Typha latifolia*, *Iris pseudacorus*, *Scutellaria galericulata*, one tuft of *Carex paniculata*, and the allegedly poisonous *Oenanthe crocata*. Adjacent marshy areas held *Carex remota* and *C. hirta*, *Hypericum tetrapterum* and many tufts of *Juncus effuses*.

In the woodland west of Scarah Bridge common woodland plants included *Hyacinthoides non-scripta*, *Anemone nemorosa*, *Mercuralis perennis*, *Sanicula europaea*, *Ribes rubrum* and *Ranunculus auricomus*. In Newton Wood were several spikes of *Orchis mascula* near the pond in the southern corner. Unfortunately, *Hottonia palustris* seen there several years previously could not be found. A pond 300 m to the east held several stands of *Schoenoplectus lacustris*, a patch of *Carex vesicaria* and *Ranunculus aquatilis*, only the second extant VC record for this species.

Most people went into Cayton Gill, where there were splendid veteran oaks at the bottom of the woodland. *Salix pentandra* graced the bank of the beck. In the northern part of the woodland was a small amount of *Ceratocapnos claviculata*. At the northern end of the grazed fields was a small bank of acid species-rich grassland. Amongst other plants it held *Aira praecox*, *Potentilla erecta*, *Pilosella officinarum* and *Anemone nemorosa*.

(J. A. Newbould)

Much of the woodland in the south-west corner of the estate proved to be NVC type W10, *Quercus petraea – Pteridium aquilinum – Rubus fruticosus*, with *Holcus mollis* and *Hyacinthoides non-scripta* the principal ground flora. Shrubs such as *Corylus avellena, Crataegus monogyna* and the occasional *Sambucus nigra* were found on the woodland edges. *Acer pseudoplatanoides* was common due to the moist climate; *Fraxinus excelsior* occurred on the wood margins as standard trees and various introduced pines were present. *Lonicera periclymenum* was common but, in spite of the names Hollybank Lane and Hollybank Wood, *Ilex aquifolium* was uncommon. The southern margins of south-facing woodland slopes were most prolific in species: *Conopodium majua* was common on the southern margins and elsewhere on the tree-lined Hollybank Lane. *Allium ursinum* was present in the wet areas of the wood and also in wet hedgebanks. *Mercurialis perennis, Stellaria holostea* and *Dryopteris dilatata* were quite common in such places. *Digitalis purpurea* was found in Ten Acre Plantation but was scarce in woods in the south-west of the park. It was good to find herbs such as *Montia sibirica* on the southern margin of Hollybank Wood adjacent to the River Nidd. In the same area on the bankside were two plants of *Luzula sylvatica*.

Just to the south of the Ripley Quarry Caravan Park, Alder Wood lived up to its name with NVC type W6 *Alnus glutinosa* woodland at the side of Newton Beck. Here wet areas had *Cardamine amara, Allium ursinium, Chrysosplenium oppositifolium* and *Equisetum telmateia*. There was also a patch of *Carex riparia* along with *Iris pseudocorus*. Higher up the bank, *Acer pseudoplatanoides* formed the tree layer.

Newton Beck was surveyed in a northerly direction from this area. Again there were beds of NVC type S6 *Carex riparia* adjacent to the stream, which was intermittently lined with *Alnus glutinosa*. Along the beck edge NVC type MG 10 *Holcus lanatus – Juncus effusus* rush pasture was mixed with MG8 *Cynosurus cristatus – Caltha palustris* grassland.

Eleven hedges were surveyed by J. A. Newbould and Colin Howes using survey forms devised by Catherine Bickmore Associates for the Countryside Survey 2000. This normally involves not only recording the species of the hedge and their quantification in a 30 m stretch using the domin scale, but also recording a 10 m stretch of hedge bank or verge similarly assessing species on the domin scale. On this occasion, however, quantification of the verge vegetation was omitted. The hedges were mainly (70%) well managed and dominated by hawthorn. One hedge adjacent had *Carex spicata* (scarce in VC64), which would not have shown up if the ground flora had been recorded strictly according to formula. The number of woody species recorded in the 30 m lengths ranged from one to nine.

MYCOLOGY (J. O. K. Webb)
Among the dozen or so Ascomycotina seen on the day, *Peziza repanda* was perhaps the most striking, being found abundantly on two square metres of leaf-covered soil. In contrast, of the 27 Basidiomycotina recorded, a single example of the Hymenochaetales was spotted in the fork of an oak at least 20 feet above the ground. Eleven Uredinales and two Ustilaginales were found. Of the nine myxomycetes found during the two days, eight were at the Cayton Gill site at the far north-east of the estate. The following are probably new records for VC64: *Arcyria denudata, Trichia favoginea, Physarum confertum* and *Stemonitis smithii*.

The two days were by no means prolific in yield, which could be put down to both the early date, particularly for Basidiomycetes, and the especially dry conditions prior to and during the two days. However, the varied habitats on the estate ranging from parkland through small woodland and garden to alder/willow carr offer considerable potential for future mycological visits. Fungi were recorded from five 1 km squares in the parkland and around the Castle. 12 Ascomycotina, 25 Basidiomycotina and 8 Myxomycete species (7 on alder) were found.

LICHENOLOGY (A. Henderson)
Over 100 lichen species have been recorded from the estate so far. Although none of these lays claim to Red Data status, this is a most gratifying list, evidencing the variety of habitats available in such an extensive landscape, as well as a degree of continuity worthy of continuing encouragement by management.

The apple trees in the Walled Gardens are, as always in a largely organically managed orchard, a source of propagule invasion (brought by birds and other vertebrates, etc.) and ultimate spread of biodiversity into surrounding areas, and have a lichen flora which includes 20 foliose and fruticose macrolichens. Furthermore, the community promises to develop still further. The total of 26 species on apple bark compares very well with totals of 33 or 34 species from the county's best orchards at Newby Hall, Parceval Hall and Ampleforth, given Ripley's situation in central Yorkshire and the greater size of the Newby orchards.

For the main part, the churchyard of All Saints' has an expectable lichen flora with a respectable total of over 60 species listed. Two species, however, merit particular mention. An old low-lying limestone grave slab bears considerable stretches of *Dermatocarpon miniatum*, a lichen highly unusual in Yorkshire's churchyards, although not infrequent in gorges and on boulders to the north of the county. The churchyard wall coping is dominated by the much more uncommon crustose lichen, *Pertusaria lactescens*. The stonework of the ha-ha supports an attractive mosaic flora of over 30 species, a community as varied as those on the walls of and around the Castle.

RIPON PARKS (VC65) 15 June 2002

INTRODUCTION (D. Milward)
Over 30 members from 17 societies attended on an overcast but dry day. The YNU was not alone in enjoying the site: Bradford Fishing Club were out in force and able to update members on matters piscatorial, as well as the latest football score, and an encampment of young army cadets, in full camouflage, gave an appropriate military ambience to this Ministry of Defence land, providing an interesting distraction when the botanists found the 'enemy' on Round Hill. Farming too gave an added dimension to this meeting. Twin lambs were born as members gathered at the start of the day, the birth being spotted by some of the earlier arrivals. Later in the day a member decided to retreat tactfully as a cow calved.

Notwithstanding all these distractions, most members had a rewarding day. Some had a very long one, as a moth trap had been set up overnight by the High Batts contingent and specimens were already identified before the majority of members arrived. Our thanks must go to the noble 'volunteer' who turned the lamp off at dawn. Dawn is very early on the 15th of June.

The Union's association with this site has been very long too. One member recalled playing here as a child and a second member still had the notes taken on a YNU visit in 1956; his report is awaited with interest.

Copies of all reports will be given to the MoD to assist them in managing this important site, and our thanks for access have been forwarded.

MAMMALS AND LOWER VERTEBRATES (M. J. A. Thompson)

Only two species of mammal were seen: a Weasel and several Rabbits. However, evidence of others was recorded. The Mole was well represented by the number of mole-hills. The skull of a Common Shrew was found at the base of an old hollow tree; careful examination of its upper teeth with a hand lens confirmed it was this species and not the Pygmy Shrew. Roe Deer are often seen in the area and evidence of their presence was confirmed by finding their slots. A search of the edge of the River Ure for evidence of Otter proved negative, although it is known that they frequent this stretch of the river regularly and use a known holt. The river, due to recent heavy rains, was high and running fast, eliminating what evidence might have remained.

Several frogs were reported by members, as well as toads (one of which was almost melanic). In the YNU Amphibian and Reptile Report for 1975 (*Naturalist* **102**: 32, 1977), Danny McAndrew and Colin Slater, both of whom were present at this Ripon Parks field meeting, describe how they counted thousands of small toads migrating out of Queen Mary Dubbs on 23 June 1975. Les Magee thought that the water quality in the Parks' ponds had deteriorated considerably due to over-stocking with fish, so that the biodiversity of freshwater organisms was considerably reduced. This being the case, the former breeding successes of the common frog and the toad are not seen today. Under rotting logs two smooth newts were located; they were last year's young according to their size.

ORNITHOLOGY (Jill Warwick)

The Ripon Parks area being so diverse, a number of groups split up to explore the various habitats including hawthorn scrub, light woodland, improved pasture, marshland, ponds and the River Ure (especially the noted gypsum cliffs). This report is therefore a compilation of many observations from a highly diverse site.

As the meeting convened, a Great-spotted Woodpecker was close by, clinging incongruously to a telegraph post. The farmyard and adjacent sheep pasture provided records of House Sparrow, Swallow, Starling and a hunting Kestrel, which later in the afternoon procured a nearly full-grown Brown Rat. The sheep were in turn accompanied by the ubiquitous Jackdaws, Rooks and the odd Carrion Crow. Warblers were well represented, six species being recorded, particularly Willow Warbler, Blackcap and Chiffchaff around the dense hawthorn scrub (especially in Fox Covert) with fewer Garden Warblers and Whitethroats and just a single Lesser Whitethroat (near the western boundary).

Breeding was much in evidence with a *crèche* of 18 Greylag goslings accompanied by four adults, on Black Heath Pond; a female Goosander on the river attended eight young. Tufted and Ruddy ducks on Queen Mary's Dubbs were behaving furtively, and several family parties of Long-tailed, Blue and Marsh Tits were more often heard than seen. In a year which has proved highly productive for Redstarts locally, two pairs were breeding, with another male observed. Willow Tit, a species of note in this area, was also suspected of breeding.

It was encouraging to note the presence of several Biodiversity Action Plan and Red/Amber List species during the day, notably Tree Sparrow, Marsh Tit, Bullfinch, Linnet, Yellowhammer and Reed Bunting. A single Grey Partridge, flushed from a fenced, weedy enclosure placed as a 'bocage' near the north-western boundary, was a record of a now increasingly scarce species in Yorkshire.

One of the most notable omissions from this summary is Turtle Dove, Ripon Parks having been one of the favoured local sites for this dwindling species – a worrying trend for an otherwise delightful area. A total of 52 species was recorded for the day.

Conchology (D. J. Lindley & A. A. Wardhaugh)
Ripon Parks has been known for a number of years as one of only two recent Yorkshire sites for the RDB 3 snail *Succinea oblonga*. The exact locality of the species being unknown, a general search for suitable habitats was carried out. The morning was spent looking in the areas of Black Heath Pond, Queen Mary's Dubb and Round Hill for wet sites with open mud. All these proved negative for *S. oblonga* but a total of 31 species was found. It was interesting to note that *Vallona excentrica* and *Vertigo pygmaea* were fairly common in the open grassland. Round Hill also produced a single specimen of *Candidula intersecta* and possibly a fresh dead shell of *Trichia plebia*, unfortunately unconfirmed without dissection. Black Heath Pond itself was not looked at in great detail and only 7 species were recorded, the most interesting being *Blythinia tentaculata*, not usually associated with enclosed water bodies. Introduction with plants is suspected in this case. The areas covered in the morning gave a typical grassland fauna.

Following lunch the open marsh area within Fox Covert was examined; this was fairly rich with 26 species being recorded from it. Both *Vertigo substriata* and *V. antivertigo* were readily found by eye, not always an easy task with these small species. It was interesting to see very large numbers of *Zonitoides nitidus* crawling on the bare mud together with *Oxyloma pfeifferi*, but no *Succinea oblonga,* although the site looked textbook. Another good quality species found was *Ashfordia granulata* which has a widespread but local range within Britain.

Finally, the small water meadow by the side of the Lightwater stream to the North West of Yew Tree Hill was examined, centred on SE/300757. It appeared to be a promising site with large numbers of *Oxyloma pfeifferi* crawling on bare mud together with other wet-loving species including *Vallonia pulchella*. Eventually *Succinea oblonga* was located crawling on the undersides of sticks lying in longish wet grass on the north side of the meadow. It was found in a thin band *c*. 1-2 metres deep and *c*. 80 m long. This was not the known site for it at Ripon Parks and is an extension of its range. The site also lies within two 10 km squares. It would be interesting to carry out a fuller survey to determine the exact extent of the colony. 50 species were found throughout the day.

Lepidoptera (H. E. Beaumont)
Previous rain left vegetation wet when the meeting commenced, although there was a continued improvement in conditions as the day progressed. The morning was spent looking at damp areas in the valley bottom, the most notable moth seen being a single *Olethreutes olivana*, scarce in Yorkshire with only a single previous VC64 record. Features of the area were the numerous larval borings of the *Sesia bembeciformis* in cut sallow stumps and later, with improving weather, good numbers of *Odezia atrata*. Mrs J. Payne recorded three butterflies, Large White, Peacock and Large Skipper.

During the course of the afternoon Dr C. Fletcher, his wife and H.E.B. made a brief visit to High Batts Nature Reserve where, in the VC65 area of the Reserve, there was evidence of larval feeding of *Limnaecia phragmitella* in seed-heads of *Typha* and several adult *Pammene aurana* sitting on hogweed umbels, both first records from VC65. Two worn examples of *Ethmia quadrillella* were swept from the abundant comfrey where Dr Fletcher had seen fresh moths earlier in the year; it remains very local in Yorkshire with few records.

Plant Galls (J. & K. G. Payne)
Plant Galls, other than those formed by Rust Fungi were scarce. (For Rust Fungi see the mycological report below.) *Prunus spinosa* supported *Phytoptus similis* in quantity on the leaves and *Taphrina pruni* infected a few sloes causing deformation. In neither size nor quality, however, were they the equal of those in the area of the lower Ouse at present. *Cecidiophyes galii* affected some plants of *Galium aperine*, causing curling and thickening. *Jaapiella veronicae* was found affecting the terminal buds of many plants of *Veronica chamaedris*. *Acer compestris* leaves produced small, reddish protuberances caused by

Artacris cephalonea. All the galls, except the fungal one on sloe, were caused by mites. *Scutellaria galericulata* had leaf rolls, but no gall-maker was found. Although much of the woodland visited was *Crataegus*, no galls were found and no *Quercus* was examined. As the nearby hedgerows and parts of the woodland ground flora had been sprayed causing abnormal growth forms, circumstances were not conducive to recording botanical specimens.

Botany (Deborah Millward)
It was difficult to decide which species recorded at Ripon Parks was the most important as there are three contenders. For sheer abundance on site, and rarity in the rest of Yorkshire, probably *Oenanthe aquatica* would get the gold medal. This species is now very scarce in Yorkshire but occurs at every pond in Ripon Parks (and there are several), often in profusion. A new record for VC64 (and possibly the whole of Yorkshire) is *Thymus pulegioides* which occurred on Round Hill. Alternatively, prime position might be awarded to *Carex ericetorum* which is not a common plant nationally having declined rapidly in recent years and become a cause for concern, so that this new record on Round Hill is encouraging.

Although these three species take the medals, there are some very honourable runners-up: *Hottonia palustris* was abundant at one pond and *Catabrosia aquatica* at another, both species very local in Yorkshire. A single plant of *Dryopteris carthusiana*, again scarce in the county, was also recorded. The 'also rans' include *Schoenus nigricans* and *Serratula tinctoria* in the fen area, and *Ophrys apifera*, again on Round Hill. Further survey work is continuing at Ripon Parks and a full species list will be filed with the Botanical Section.

Mycology (J. O. K. Webb)
Despite the dry conditions, which a light shower did little to improve, 46 species of fungi along with 5 species of Myxomycete were collected. The Agarics provided the most interesting finds. *Hygrocybe persistens*, found by Judith Allinson, is worthy of particular mention, occurring where there were interesting flowering plants in an area of unimproved grassland which perhaps favours this genus. 'Pluteus' sp., found by Bert Brand proved to be (after microscopic examination) *Volvariella speciosa*, an apparent lack of volva making field identification difficult. This site requires further attention.

Lichenology (A. Henderson)
Walls and cemented sandstone blocks in the immediate area of the farm yielded a selection of species expected in such an agricultural setting. Nonetheless, well-developed *Physconia grisea, Rinodina teichophila* and *Pertusaria corallina* were very pleasant finds. Fencing posts and struts had the typical mixture often seen of circular and crescent-like thalli of *Caloplaca decipiens*, together with black crusts of *Micarea denigrata*. An interesting micro-community on an iron farm gate consisted of *Candelariella vitellina, Rinodina gennarii, Lecanora saligna* and *Lecanora polytropa*. No really prolific community was seen on trees in the area studied to the north-west of the farm, but the pin-like fruits of *Calicium viride* and pycnidiate *Cliostomum griffithii* were occasional. Altogether 47 species were recorded during the day.

ELMSWELL, GREAT DRIFFIELD (VC61) 6 July 2002

Introduction (J. Lambert)
The parking spot on the Driffield by-pass lies across a very busy main road north-west of King's Mill. Amongst the 16 members present was Dr Eric Chicken whose local knowledge and list of plants found in 1996 were invaluable to the botanists. Although the area is not very large, it contains a variety of habitats including the drier grassland of the tumulus within the SSSI. Here at mid-day some members lunched on the slopes of the ancient Bronze Age bowl barrow. Areas nearby, such as the churchyard at Little Driffield,

were also visited by some of the members. Few vertebrates were noticed, but there were two sightings of water voles, one being a very good view of a large specimen seen from Cow Bridge, Little Driffield. A family of Mute Swans with six cygnets was also seen.

Nine members were present at the meeting for reports held at The Blue Bell in Driffield. The meeting was chaired by the President, Harry Beaumont and a vote of thanks was given to Mr Mackrill for allowing access to the SSSI and to Dr Chicken for sharing his long experience of the locality.

LEPIDOPTERA (H. E. Beaumont & A. Grayson)

Despite reasonable weather conditions, the number of moths observed was low and almost entirely of common and widespread species. Large Skipper, Small Tortoiseshell, Ringlet and Meadow Brown were seen and the only moth of note was *Neosphaleroptera nubilana,* several of which were flying along a hawthorn hedge near the road; there have been relatively few Yorkshire records in recent years, but it is evidently local but can be plentiful. A total of 14 moth species was recorded.

DIPTERA (A. Grayson)

Despite the brightness of the day, the sun was perpetually obscured, on an otherwise pleasantly warm (up to 19°C) day with very light wind. To an entomologist's eyes, the site was somewhat intriguing, as it contained a mosaic of various lowland habitat types which appear not to be degraded and could therefore support a number of uncommon species. The most interesting, and spectacular, find of the day was a female *Stratiomys singularior* caught in flight in grassland between the tumulus and the beck. This is the most northern record of *S. singularior* in Britain (see *Larger Brachycera Recording Scheme Newsletter* **22**: 3; 2003). Other soldier-flies taken were *Beris vallata, Chloromyia formosa* and *Chorisops tilialis*, whilst the cleg *Haematopota crassicornis* was encountered in an area of sheltered sedges. The most noteworthy hoverfly taken was *Platycheirus rosarum*, which is usually considered to be a very local species in Yorkshire.

BOTANY (R. Middleton)

Although this site has now been completely encircled by recent road, housing and industrial development, leaving it an island under increasing pressure, once prominent marsh species, such as *Pedicularis palustris* and *Menyanthes trifoliate*, were not recorded on this visit, suggesting that water levels and/or quality are declining. On a more positive note, it was pleasing to see some marsh plants, such as *Caltha palustris, Thalictrum flavum, Lychnis flos-cuculi* and *Hydrocotyle vulgaris*, still flourishing. The flowing waters supported healthy populations of *Hippuris vulgaris* with marginal *Apium nodiflorum, Myosotis scorpioides* and *Mentha aquatica*.

The surrounding drier land had a relatively rich flora, typical of local calcareous grassland, including *Centaurea scabiosa, Galium verum* and *Pimpinella saxifraga*. Areas with more neutral conditions were indicated by the presence of *Potentilla erecta, Stachys officinalis* and *Carex disticha*. Other species of note included the orchids *Listera ovata* and *Dactylorhiza fuchsii*. The adjacent fields provided the usual crop of arable weeds including *Fumaria officinalis, Viola arvensis* and *Anagallis arvensis*. The rapidly-spreading halophytic grass, *Puccinellia distans* was present in the spray-zone of the adjacent by-pass.

(D. R. Grant)

The area of marshland adjacent to the River Hull (West Beck) on the western fringe of Driffield had large colonies of *Juncus subnodulosus* growing with *Phragmites australis* and *Phalaris arundinacea*. In the western edge of the field there was a small stand of *Thalictrum flavum* growing with *Polygonum amphibium* and *Apium nodiflorum*. The ponds had *Typha latifolia, Veronica catenata* and *Galium palustre* on the margins. Other damp areas were colonised by *Carex disticha* together with *Valeriana dioica, Dactylorhiza fuchsii, Galium uliginosum, Triglochin palustre* and *Pulicaria dysenterica*. Other parts of

the marshland yielded *Carex acutiformis*. In the drier area near the entrance there was plenty of *Carex hirta*, and in shorter turf two colonies of *C. spicata* were found. A tumulus composed of chalky soil was the home of many calcicolous plants: *Poterium sanguisorba, Centaurea scabiosa, Reseda lutea, Brachypodium pinnatum, Leontodon hispidus* and *Listera ovata*. The drier area near the river was covered with many plants of *Primula veris*.

Brambles were represented by only one species *Rubus halsteadensis,* which is the commonest species for East Yorkshire. The river had large colonies of *Ranunculus penicillatus* subsp. *pseudofluitans* (see Eva Crackles' *The Flora of the East Riding of Yorkshire*), frequent in Yorkshire. Growing on the banks were *Scrophularia auriculata* with Most of the species on Dr E. Chicken's list of 1996 were seen, except for early flowering plants and *Carex paniculata*. *C. pendula*, not on Dr Chicken's list, was observed in several places. A total of 161 species was recorded.

MYCOLOGY (Chris Yeates)

Only areas to the east of the main road were examined. These had been visited 63 years previously (almost to the day) by W. G. Bramley; interestingly few of the 20 or so species he recorded then were seen on this occasion. Among the ascomycetes, the *Phomopsis* anamorph of *Diaporthe pulla* was recorded on dead *Hedera* twigs; this was the third Yorkshire record and was new to VC61. The discomycete *Ascobolus crenulatus* appeared amongst commoner species on incubated rabbit pellets; there are only five previous Yorkshire records.

The site is relatively rich in rust fungi. Most noteworthy were *Puccinia urticata* var. *urticae-hirtae* ; this was new to VC61 and there are only three other Yorkshire records, and indeed only 19 other British and Irish records on the British Mycological Society's Fungal Records Database (BMSFRD) Aecia of *Puccinia distincta,* a rust on *Bellis perennis*, were rather frequent on the site; this is the fourth Yorkshire record of a species first reported in Britain in 1997 (probably an introduction) which has spread rapidly in England and Wales (where it is now rather common and is potentially a threat to commercial forms of *Bellis*).

Among the so-called "imperfect fungi", the coelomycete *Septoria cerastii* on yellowing but living leaves of *Cerastium fontanum* was the third Yorkshire record and was new to VC61 (there are 11 other records on BMSFRD). The hyphomycete *Cephalotrichum microsporum* was another of the species to appear on the incubated rabbit pellets (5 other Yorkshire records, second for VC61). *Ramularia calthae* on *Caltha* has recently been synonymised with the very common *R. didyma* (on *Ranunculus* especially *R. repens*), this is accordingly the first time *R. didyma* has been recorded on *Caltha* in VC61.

In all some 50 species were recorded.

LICHENOLOGY (A. Henderson)

The trees on the reserve with most lichen cover were *Sambucus* and *Salix*, a large *Salix* by the riverbank having the only *Ramalina farinacea* seen during the morning. Encouraged by the agricultural ambience, a *Xanthorion – Physcietum* was well in evidence. Wooden and concrete posts added variety to the list of 36 species from within the reserve boundaries. In a few areas, damper grasses were draped with 9-12 cm lengths of the gelatinous cyanobacterium, *Nostoc commune*, described by Coleridge in his 1803 notebook as "the stinking tawny Jelly of a fal'n Vapour or the nocturnal Pollution of some plethorical and wanton Star".

In the afternoon the two lichenologists moved on to St Peter's church, Little Driffield. Headstones here had fine examples of the yellow and white morphotypes of *Haematomma ochroleucum*, var. *ochroleucum* and var. *porphyrium*. One upright gravestone had its inscription perfectly highlighted by the neon-greenish powder of *Psilolechia lucida*, recalling the war poet Sidney Keyes' phrase on his dead comrades, "their epitaph In lichens written". 53 lichen taxa were recorded during the day.

CASTLE HOWARD (VC62) 27 July 2002

INTRODUCTION (John Blackburn)

Eighteen members parked on set-aside land east of Welburn on a fine and eventually sunny day, for an examination of Todd, Spring and Gillylees Woods. Progress through the woods was severely hampered in places by Bracken, Bramble and Stinging Nettle, indicating an absence of management in recent years. This resulted in a less complete cover of these woods than would otherwise have been the case. The woods on both sides of Cram Beck slope down to the beck, with several springs present, much of the lower ground being very wet. Some of the springs showed evidence of base-richness in an otherwise acidic environment.

The tea and meeting, held in Welburn Village Hall, was attended by 13 members representing 11 affiliated societies. The President, Mr Harry Beaumont, chaired the meeting. Dr Michael Thompson gave a vote of thanks to the Castle Howard estate, the Huttons Ambo estate, Mr Ian Thompson for the use of his field and, finally, the village hall committee.

MAMMALS AND LOWER VERTEBRATES (Michael Thompson)

Only one mammal was reported as being seen and that was the Brown Hare, which is well established in the area, much against the downward trends elsewhere in Britain. However, using sign, track and trail, seven other species were recorded. Moles, judging by the number of molehills, especially in the woodlands, are well represented. Rodents were obviously common. Old, halved hazelnuts produced by Grey Squirrels were found in the woodlands. Bank Voles indicated their presence with clean-cut holes in hazelnuts, along with the remains of a snail's shell opened by a vole, leaving a remnant of the central spiral of the shell. Out in the rough grass areas, near Gillylees Wood, a typical Field Vole tunnel under the grass was found, with an exit hole. Wood Mouse-nibbled hazelnuts were also found, with their more jagged edge to the hole in the nut. Situated along one of Gillylees Wood's boundaries were at least two active Badger setts judging by the amount of soil that had been removed, along with foot-prints. Down near the stream, members were reporting Roe Deer slots, a species that is well established in the district.

Both newly metamorphosed frogs and toads were found in the rough grass habitat near the entrance to Spring Wood; like elsewhere in the district, it would seem that both these species had bred successfully. An adult toad was found within one of the woods.

ORNITHOLOGY (Michael Thompson)

The birds present in the study areas were, on the whole, not singing, nor were they easily visible in the dense upper canopies of the woodlands. However, those reported were of considerable interest. Of the summer visitors, the Swifts, Swallows and a single House Martin were seen from the parking site, the latter species flying over a large neighbourhood pond. These birds were obviously nesting in Welburn village. A Blackcap was seen feeding two youngsters, a Chiffchaff was heard by several members calling in the upper canopy. Several members reported hearing the Goldcrest, but not seeing it. Of the other woodland birds, Blue Tits, Great Tits and Marsh Tits were reported, along with Robin, Nuthatch and, in Gillylees Wood, a Jay. Both Green Woodpecker and Great Spotted Woodpecker were seen or heard during the day. Wood Pigeons were numerous. One member reported seeing two young Barn Owls, which locally are increasing in their numbers since the Barn Owl nesting-box scheme was started by the local branch of the Owl and Hawk Trust. Another predatory species, the Buzzard, was seen circling high above the woods, calling to what sounded like a young bird within the woods. Again, there are increasing reports of buzzards within the area, with confirmed breeding in the southern part of the Yorkshire Wolds. In a well-keepered area evidence of Pheasant was plentiful, and Grey Partridge was seen. Hedgerow birds included a singing Yellow Hammer near the parking site, some Redpolls and a pair of Wrens. Finally, on the pond, there was a Little Grebe, a Coot and a male Tufted Duck. In all 25 species were seen, a typical total at the end of the breeding season in such a woodland habitat.

Lepidoptera (H. E. Beaumont)
Butterflies were in reasonable numbers and comprised Small Skipper, Large, Small and Green-veined Whites, Small Tortoiseshell, Comma, Gatekeeper, Meadow Brown and Ringlet. Moths were much less in evidence and the relatively short list was composed entirely of species which are widespread and common.

Plant Galls (J. Payne & K. G. Payne)
Galls of 14 gall-causing species were recorded for SE7368; all are common, but none the less interesting for that. Perhaps the most interesting were first generation galls of the midge *Cystiphora sonchi* on three *Sonchus* species growing along field edges. These are pustules on the upper surfaces of the leaves and in this case were entirely green with the pupae they contained being visible through the lower side of the leaf. The species becomes more conspicuous later in the year. Galls, mainly of the second generation, show as the familiar 4-5 mm diameter purple rings on *Sonchus* leaves. The few accessible *Quercus* yielded five common *Cynipid* galls, and other plants had galls for which six *Eriophymid* mites and three *Cecidomyids* were responsible. Lists of the hosts and gall species recorded have been sent to the YNU and British Plant Gall Society Recorders.

Flowering Plants (D. R. Grant)
The area visited, at the eastern end of the Castle Howard Estate near the village of Welburn, is situated on the Jurassic Series of rocks which give rise to acid clay soils. Members spent time in the woods and in the Cram Beck valley. The hedgerows leading to the woods had many plants of *Rubus polyanthemus* and *R. eboracensis*, together with *Viburnum opulus*. In the woods there were large colonies of *Rubus dasyphyllus,* with a little *R. hylocharis* in one place. There were some healthy trees of *Ulmus procera* and a magnificent veteran *Quercus robur*, together with a little *Brachypodium sylvaticus*.

In the valley bottom there was a large stand of *Phragmites australis,* with scattered plants of *Eupatorium cannabinum* and *Scrophularia auriculata*. A ditch at the side of the main path yielded *Juncus acutiflorus*, with *Carex hirta* and *Odontites vernus* growing on the grassy edge. The rarest plant species found on this excursion was a colony of *Scirpus sylvaticus* in the Cram Beck valley.

Bryology (J. M. Blackburn)
The wooded slopes had the most prominent flora, with *Altrichum undulatum, Brachythecium rutabulum, Eurhynchium striatum, Mnium hornum, Plagiomnium rostratum, P. undulatum, Thamnobryum alopecurum* and *Pellia epiphylla* present. In Gillylees Wood a large patch of *Cratoneuron commutatum* was growing in marshy ground by Cram Beck with *Eucladium verticillatum* on the beck-side, indicating some base-richness in the spring water. Epiphytes recorded included *Dicranoweisia cirrata, Hypnum cupressiforme* and *Orthotrichum affine*, with *Lepidozia reptans* on some tree bases. An interesting record on rotting logs was *Dicranum tauricum*. This moss, first recorded in Britain in the mid-1860s, was rare until the 1930s. Its older leaves tend to break off at the tips, making it easy to identify. Rocks in the beck supported *Brachythecium plumosum, B. rivulare, Dichodontium pellucidum, Fontinalis antipyretica* and *Rhynchostegium riparioides*. A total of 39 species was recorded on the day.

Mycology (Chris Yeates)
The streamside woodlands to the east of the car parking area were explored by the writer and Dr Jerry Cooper; 55 species were recorded, the more significant of which are enumerated here. The downy mildew *Peronospora potentillae-sterilis* on *Potentilla sterilis* was found in very small quantities; this was its fifth Yorkshire record, it was also reported from Kirkdale (VC62) on the YNU meeting in August 1988. There are only seven other records on the British Mycological Society's Fungal Records Database (BMSFRD). The discomycete *Hymenoscyphus albidus* was found on its classic substrate – fallen *Fraxinus*

petioles. This was the fifth certain record of the nominate form (two previous records on *Aesculus* petioles are probably referable to var. *aesculi*). Among the "imperfect" fungi, the coelomycete *Ascochyta heraclei* on *Heracleum sphondilium* leaves was the second Yorkshire and first VC62 record. Of the hyphomycetes, *Acremoniella atra* on dead *Phragmites* stems and *Ramularia heraclei* on *Heracleum sphondylium* leaves were both sixth county records; *Ramularia circaeae* forming dead patches on living leaves of *Circaea lutetiana*, was a fourth Yorkshire record (there are only 16 records on the BMSFRD).

LICHENOLOGY (A. Henderson)
The dense shade of Gillylees Wood proved to be comparatively unproductive of lichens with only 24 species recorded. The most interesting time of the morning was spent studying an acidophile community on an old oak stump outside the wood, which included six *Cladonia* species along with *Placynthiella icmalea*, *Trapeliopsis flexuosa* and *T. granulosa*, the last with no apparent thallus and huge black fruits.

In the afternoon the two lichenologists moved to nearby Bulmer village and churchyard. The calcareous substrata of the village had a prolific flora of limited variety, about two dozen species, the most striking of them *Diploicia canescens* and *Opegrapha saxatilis*. Inside the churchyard, one table grave had a fine mosaic of *Acarospora fuscata, Candelariella vitellina, Lecanora soralifera, L. sulphurea, Porpidia tuberculosa* and *Scoliciosporum umbrinum*. Other gravestones added *Caloplaca teicholyta* and *Pertusaria corallina* to a list of 61 species for the day.

WORSBROUGH COUNTRY PARK (VC63) 10 August 2002 (D. G. Hemingway)

INTRODUCTION (J. D. Coldwell)
On a rather dull and cool morning after rain the previous day, a fairly low turn-out of members – with lichenologists predominating – assembled in the visitors' car park. For the benefit of members new to this attractive and well-worked locality, a brief outline of the history of the site was given and the publication *The Flora and Fauna of Worsbrough Country Park* was produced and evoked favourable comment. The main habitats were visited by most members who had an enjoyable, if not, for some sections, an especially productive day.

Thanks are due to the Country Park staff for making available the facilities of the Field Studies Centre and to local farmer Andrew Siddons who kindly allowed access to his water meadow which lies alongside part of the Country Park. Ten Affiliated Societies were represented at the tea and reports meeting chaired by the President, Harry Beaumont.

LEPIDOPTERA (H. E. Beaumont)
Following a period of considerable rainfall overnight the day remained dry but cloudy during the excursion. This resulted in conditions being unsuitable for sweeping, most moths recorded being either disturbed from vegetation or found sitting on tree trunks by Gavin Boyd and myself. The same conditions meant that few butterflies were seen, the only species noted being Small Skipper, Large and Small Whites and Gatekeeper.

Among 34 species recorded during the day, the most notable was *Phyllonorycter platanoidella*, larval mines of which were found in small numbers on Norway Maple; this moth has only been recorded in Yorkshire since 1998 and it is presently known only from half a dozen sites in vice-counties 62 and 63. Another relative newcomer to the Yorkshire fauna is *Epiphyas postvittana,* a moth of Australian origin, which has spread rapidly northwards in Britain during the past two or three years, becoming very common in the south of the county; a single example was disturbed from streamside vegetation. The remaining moths encountered were widespread species, but included the attractive *Pyrausta aurata* and *Ypsolopha sequella*.

ENTOMOLOGY (G. Boyd)
Cool and cloudy conditions after heavy overnight rain had saturated vegetation and caused

heavy flow in the streams running through the site. Marshy areas and river banks were flooded and inaccessible. Since the vegetation was too wet to sweep, we were reduced to general observation supplemented by shaking branches to flush out any roosting insects. The visit, from 10.30 to 15.50 hr, produced the following species: *Pterostichus madidus* (Odonata) and *Ptychoptera contaminata, Episyrphus balteatus, Cheilosia pagana, Leucozona glaucia, Myathropa florea, Volucella pellucens* and *Eriothrix rufomaculata* (Diptera) and an acalyptrate fly of the family *Lauxaniidae*.

(J. D. Coldwell)
A full day in the field produced very little for the entomologists due to the damp vegetation which effectively prevented sweep-netting. The cranefly *Cylindrotoma distinctissima* was recorded (whose larvae uniquely feed on herbaceous plants in wet woods), but the fungus gnats, the writer's target group, were almost non-existent; *Brevicorna sericoma, B. fissicauda* and *Isoneuromyia semirufa*, the latter found by Mr Giggal, were the only species discovered. The willow carr yielded the local picture-wing fly *Philophylla caesio*, often regarded as scarce, but common enough here and the mottled-winged, tephritid-like sciomyzid *Trypetoptera punctulata*. The best dipteron of the day was the handsome tachinid *Phasia hemiptera*, a rather scarce Yorkshire species only seen occasionally in the Barnsley area. The small yellow empid *Rhamphomyia* (*Holoclera*) *flava* was common on umbels. Of the hymenoptera, only the common sawflies *Selandria serva* and *Athalia circularis* were recorded, the season being late for these creatures, and the only aculeate found proved to be the 'wall mason wasp' *Ancistrocerus parietum*. *Sisyra fusca*, a spongefly, was swept from the river in the carr area. This dark winged neuropteron is stated to be very local and variable in abundance but was also reported from Cawthorne on a recent YNU excursion. The only beetle of note was the chrysomelid *Pyrrhalta viburni* on Guelder Rose, reported by Mr Hemingway.

Plant Galls (Derek Allen)
Galls were collected from trees on either side of the footpath leading roughly south-west from the mill along the southern side of the reservoir. Four wasp, one fly, one sawfly, one midge and three Eriophyid mite galls were determined/confirmed by Mr Tom Higginbottom.

Flowering Plants (J. Lambert)
Along the south side of the reservoir a variety of shrubs and trees included *Fraxinus excelsior*, *Alnus glutinosa*, *Corylus avellana*, *Viburnum opulus*, *Salix* sp. and *Sambucus nigra*. *Ulmus glabra* was dying back in places, some had developed corky bark on the twigs. There were fine specimens of *Rosa arvensis*, some climbing up into *Crataegus monogyna* and *Prunus spinosa*. The drier woodland had much *Quercus robur* and *Acer pseudoplatanus* with some *Fagus sylvatica* and *Acer campestre*. Introduced species such as *Aesculus hippocastanum* and *Prunus lusitanica* were also noted. Ground flora included *Oxalis acetosella*, *Silene dioica*, *Myosotis sylvatica* and *Dryopteris filix-mas*. In the damper woodland *Bromopsis ramosa* was seen, with *Filipendula ulmaria*, *Impatiens glandulifera* and *Urtica dioica* predominating in the willow carr. In the more open areas some large, white-flowered plants of *Galeopsis tetrahit* s.l. were seen. In the past, *G. bifida* and the rare *G. ladanum* have been recorded in the park. In one area an old osier bed provided a different habitat with *Geranium dissectum*, *Convolvulus arvensis*, *Artemisia vulgaris*, *Malva sylvestris* and *Silene vulgaris* with other waste land and arable weed species.

Mycology (J. O. K. Webb)
During the day, 7 Myxomycetes, 16 Basidiomycetes and 17 Ascomycetes were found. *Stemonitopsis typhina* was probably the mycological find of the day. This taxon is a not uncommon find on fallen wet soggy wood. In this case the white plasmodium, *c.* 1 cm in diameter, was found in a nodule of *Salix* bark, 2 m from the base of the trunk, which was

the scarred site of a broken limb that formed a rainwater bowl as a result of a day's rainfall. Conditions were apparently at an optimum to trigger the production of the plasmodium; this was developed in a petri dish, growing to 3-4 cm before fruiting to produce a particularly good specimen destined for the herbarium.

LICHENOLOGY (A. Henderson & C. J. B. Hitch)
When Dr Oliver Gilbert contributed a list of 17 lichen species to *The Flora and Fauna of Worsbrough Country Park* (1996), he commented that it probably represented only a third of the species then present, as epiphytes were recovering fast in South Yorkshire. The surprisingly large contingent of five lichenologists studied only one third of the Park, but 72 species (45 crustose, 17 foliose and 6 fruticose) were recorded. Particularly interesting were the easily overlooked grey crust *Caloplaca obscurella* near the base of *Sambucus*, *Lecania hutchinsiae* on the stone of the bridge near the field centre, *Melanelia exasperata*, *Verrucaria elaeina* and *Ramonia interjecta* immersed in the soft barks of *Sambucus* and *Salix*.

BOOK REVIEW

Coral Reefs. Cities under the Sea by **Richard C. Murphy.** Pp. 177, with colour frontispiece and 172 colour plates. The Darwin Press, Princeton, N.J. 2002, £36.50 hardback.

Coral reefs are the largest structures on earth created by living organisms. They are also highly complex ecosystems inhabited by a vast range of animals and plants (algae) – and are extraordinarily beautiful. Thanks to television programmes and lavishly illustrated books such facts are now well-known even to non-naturalists, but just how reefs are organised, how they function and how they maintain their enormous diversity are much less widely understood. This book attempts to explain such matters by likening coral reefs to man-made cities which require power plants (provided in reefs by solar energy), buildings (furnished by corals, sponges and other organisms), a means of waste management and recycling programmes (at which coral reefs are so extremely efficient that they can flourish in nutrient-poor regions), a system of public health (illustrated for coral reefs by such things as cleaner fishes), and so on. In the course of so doing it presents the reader with fascinating glimpses of the structural diversity of reef animals and of intriguing aspects of their biology, illustrated by many magnificent photographs.
The author is clearly familiar with a wide range of organisms, but occasionally errs. Not all bivalve molluses are filter feeders. Most are, but the wood boring *Teredo* and *Xylophaga* subsist on wood, and septibranchs suck up organic detritus. Presentation is clear, but the current fashion of using 'multiple' for 'several' or 'many', jars – as in 'multiple jobs'. A glossary definition of 'demersal zooplankton' (a contradiction in terms) as "Animal plankton that emerge at night" is grotesque in meaning (what has night got to do with it?), and grammar, plankton being a collective noun and singular. Otherwise this is an informative and attractive problems.
Sadly, as the author tells us, coral reefs are under threat from sediments and nutrients released by man's activities, over-exploitation of their fishes, even by the use of dynamite which wrecks the entire edifice, and by warming of the oceans. To end on a dismal note, a recent El Niño event destroyed about 16% of the world's corals on reefs in 9 months. Like so many of the earth's treasures, coral reefs need, and surely deserve, our protection.

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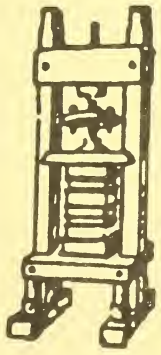

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Volume 129

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The Naturalist

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FORM AND FUNCTION IN *SPHAGNUM* – A REAPPRAISAL

D. J. BOATMAN

Presidential address presented to the Yorkshire Naturalists' Union at Halifax, 6th December 2003

The morphology of members of the genus *Sphagnum* differs to such an extent from that of other mosses that the genus is placed on its own in a higher taxonomic group. Early authors consider this higher group to be one of three within the Musci, the mosses, as distinct from the Hepaticae, the liverworts, but Smith (1978), gives the genus *Sphagnum* class status so that taxonomically it is equivalent to most of the liverworts put together (the Hepaticae, Smith 1990) and most of the mosses put together (the Bryopsida). The main features of taxonomic importance relate to the sporophyte but certain morphological features of the gametophyte of *Sphagnum*, when taken together, also separate the group certainly from all other British bryophytes.

The main axis of a *Sphagnum* shoot terminates apically in a group of underdeveloped lateral branches known as the capitulum (Fig. 1a). When fully developed the lateral branches can be seen to arise from the stem in bunches known as fascicles. On plants which are mostly exposed to the atmosphere, some of the lateral branches in a fascicle project more or less at right angles from the stem while others are pendant and hang close to the main axis. Each of the latter, however, is a lateral branch of a projecting branch. On aquatic species all of the branches generally project. Occasionally a projecting branch is replaced by a shoot which resembles the main axis. Early morphologists (Goebel 1887, Parihar 1956) refer to these shoots as innovations but the term has been used by Rochefort *et al.* (2002) for branches which arise *de novo* from just above a fascicle after the capitulum has been removed. The older usage will be retained here.

The leaves of a *Sphagnum* shoot are borne both on the main axis and on the branches. Typically the leaves consist principally of two types of cell, long narrow cells containing protoplasm and chloroplasts, sometimes referred to as chlorophyllous cells, and relatively wide elongated cells, the hyaline cells, which are devoid of protoplasm and have walls strengthened by numerous rings of thickening. The two types of cell are interspersed throughout the leaf. Stem leaves, though differing in shape from those on the branches, also contain both types of cell though often the small cells lack chloroplasts. Cell differentiation appears most marked in the leaves of the projecting branches.

Aspects of *Sphagnum* Ecology

Sphagnum communities are likely to develop initially or ultimately wherever the rainfall and topography are such that the underlying substrate is waterlogged for long periods of the year, especially in the Boreal and Cool Temperate regions of the Northern Hemisphere. In these conditions vegetable matter fails to decompose completely and gradually accumulates as peat. Where the ground water is rich in mineral nutrients fen communities develop but, as the peat accumulates, the vegetation comes to depend progressively more on the rain as a source of mineral nutrients (ombrotrophic conditions) and it is then that species of *Sphagnum* appear. Some species can survive and grow where the rain is the only source of nutrients and here, in habitats known as peat bogs, they can become very significant components of the vegetation.

In his seminal work on the ecology of British vegetation, Tansley (1939) distinguishes three types of peat bog, raised, valley and blanket bog. In Yorkshire Thorne and Hatfield Moors were once good examples of the first type, Fen Bog and the many flushes on the North Yorkshire Moors of the second and the extensive bogs of the higher Pennines of the third. With such a wealth of bog types it is not surprising that some twenty species of *Sphagnum*, about two-thirds of the British total, have been recorded in Yorkshire (Appleyard 1982). According to Wall and Limbert (1987) several species are still "fairly common" or "common" on Thorne Moors despite the extensive exploitation for peat, and

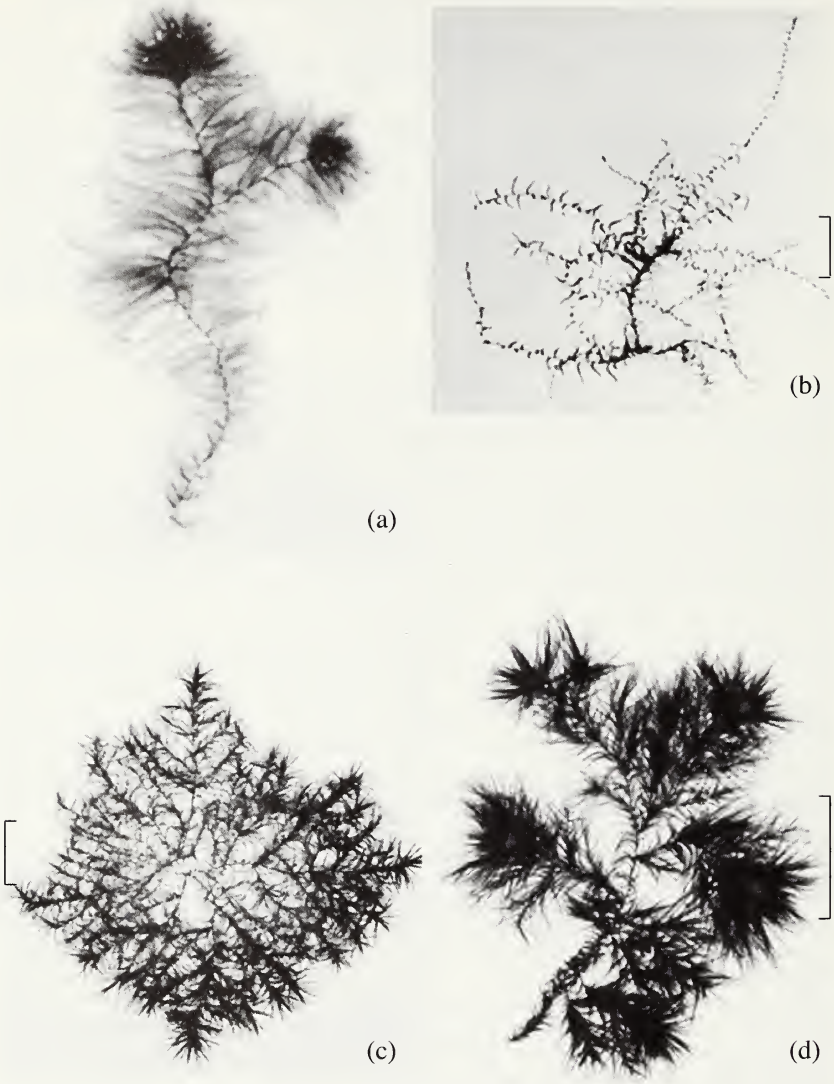

FIGURE 1.
(a) A shoot of *Sphagnum cuspidatum* taken from the field, (b) a shoot grown for 4 weeks in 0.1S solution +air (see text), (c) a shoot grown for 4 weeks in 0.1S solution and 0.5% CO_2, (d) a shoot grown in 0.006S solution and 0.5% CO_2. Scale bars = 10mm.

Pearsall (1941) recorded 10 species of *Sphagnum*, four of which were widespread and common or abundant, on the bogs of the Stainmore district in the Pennines. However, from a comparison of his survey with one nearly 40 years earlier (Lewis 1904), he concluded that a considerable area of Sphagnetum had been destroyed as a result of burning and grazing. Further south, Moss (1913) recorded 18 species of *Sphagnum* on the moors of the southern Pennines, only two of which he considered to be rare, but by the early 1960s Tallis was able to record only five species in this region (Tallis 1964). This severe reduction of species on the southern Pennines is probably a consequence of atmospheric pollution (Press *et al.* 1983).

The surface of many peat bogs, especially the so-called raised bogs, consists of a mosaic of hummocks and hollows thus providing a variety of micro-habitats in which different species of *Sphagnum* can flourish. At one time it was believed that hummocks and hollows replaced each other in a cyclical manner, the so-called regeneration complex hypothesis first put forward by von Post and Sernander (1910). According to this hypothesis the hummock species rose so far above the water table that they ceased growing became smothered by leafy liverworts and more xerophilic mosses and died. Meanwhile peat formation continued in the hollows and the aquatic or semi-aquatic species living there were replaced first by "carpet" species and then hummock species. By this time the former hummocks had become hollows and the cycle was repeated. However, Barber (1992) was unable to find convincing documentary or field evidence to support this widely accepted hypothesis.

In the north and west of Scotland there are large areas of peat bog, known as "flowes", where pools, often of considerable size, occupy a substantial proportion of the bog surface. From a study of aerial photographs Bower (1959, 1961) concluded that many of the Pennine bogs, which are now severely degraded as a result of gully erosion, were once of this type. On the Scottish flowes the pools can be quite deep, up to a metre or more, and various hypotheses have been put forward to explain how these develop. A brief summary of these hypotheses is presented by Moore and Bellamy (1973) and by Rodwell (1991) in his discussion of the habitat of the "*Sphagnum auriculatum* bog pool community".

To the present author it seemed that the pools must have developed as the bogs themselves developed and that the production of peat by the more hydrophilic species of *Sphagnum*, which still occur in these pools, must have failed to keep pace with that elsewhere. This reasoning led him to embark on a study of the growth of one of the hydrophilic species, *Sphagnum cuspidatum*, in a variety of field micro-environments on the Silver Flowe, a National Nature Reserve in south-west Scotland. This reserve consists of a series of small areas of bog with deep pools separated from one another by featureless blanket bog (Ratcliffe & Walker 1958, Boatman 1983).

Growth of *Sphagnum Cuspidatum* in Stagnant and Flowing Water

Shoots of *Sphagnum cuspidatum* were taken from a swallow hole in a shallow valley beside one of the ombrotrophic areas with shallow pools on the Silver Flowe, cut to a specific length and anchored in one of the ombrotrophic pools. Shoots from the ombrotrophic pool were treated similarly. The experiments were undertaken in three successive years. On each occasion the shoots from the swallow hole put on more extension growth than those from the stagnant pool but another unexpected difference involved innovation production. Up to 75% of the shoots from the swallow hole produced one or more innovations during a six-month summer period while a maximum of only 8% of those from the ombrotrophic pool produced innovations over nine months (Boatman 1977). Clearly, therefore, the ability of the latter to maintain a population of plants by vegetative reproduction i.e. innovation production, is much less than that of the former.

Later Baker took samples from a variety of habitats on the Silver Flowe, including surface flushes as well as those of the types already mentioned, and found that more innovations were produced at sites where the water was flowing than where it was stagnant (Baker & Boatman 1989). The absorptive surfaces of plants are able to absorb more nutrients from flowing than stagnant water because the concentration gradients of the

nutrients are shortened. Analysis of the capitula of plants taken from the swallow hole before they were used for the third experiment described above showed that the nitrogen content (mg. g^{-1}) was about 50% higher than that of those taken from the ombrotrophic pool. It seemed likely, therefore, that the greater production of innovations by the swallow hole plants was a consequence of the higher nitrogen availability. In order to test this hypothesis a series of experiments were undertaken in the laboratory.

Production of Plants for Experimental Purposes

Algae are abundant in the pools of the Silver Flowe so it was considered undesirable to use mature plants from this site for laboratory experiments because of the competition that would ensue between the moss and the algae. Instead the experimental plants were grown from spores sown on an agar gel made up with Long Ashton Solution, one of the standard mineral nutrient solutions used for growing plants.

As with all mosses, leafy shoots of *Sphagnum* are not produced directly from the spores. Instead a protonema is produced. In most mosses, this is filamentous but in *Sphagnum* it can be filamentous or thalloid depending on the conditions in which it is grown. On the standard, i.e. full strength, solution the protonema is thalloid but on a very dilute solution it is filamentous (Boatman & Lark 1971).

After a few weeks one or more leafy shoots appears on each protonema and it was these that were used to study the effects of mineral nutrients on the growth of shoots (Baker & Boatman 1985).

Some effects of Mineral Nutrients on the form of *Sphagnum* Shoots

All of the experiments to be described were conducted in a constant temperature illuminated growth room and plants were grown in culture vessels containing a slightly modified version of the Long Ashton solution (Baker & Boatman 1985). Such solutions are designed for the culture of flowering plants and are much more concentrated than those experienced by *Sphagnum* spp. in natural conditions. In most of the experiments, therefore, the solution was diluted. As an example 0.1S solution represents the standard Long Ashton solution diluted ten times. Leafy shoots produced as described above were transferred from agar to the culture solution when they were a few millimetres long. A detailed account of the experimental procedure is given in Baker and Boatman (1985).

Sphagnum species are photosynthetic autotrophs and therefore require carbon dioxide for their survival and growth. It is well known that the rate of diffusion of carbon dioxide through water is extremely slow. Even very thin films of undisturbed water can severely reduce the rate of photosynthesis by plant cells (Smith & Walker 1980). In the experiments to be described plants were grown in special containers so that air or air enriched with carbon dioxide could be bubbled through the solution. This had the effect of both raising the concentration of carbon dioxide in the solution and of disturbing the water around the plants. Further details of experimental procedure are provided in Baker (1988).

Figures 1b and 1c show shoots of *Sphagnum cuspidatum* grown for four weeks in 0.1S solution through which either air or air containing 0.5% carbon dioxide was passed. There were five plants in each culture vessel and in each case the one shown is that judged by eye to be "average". The branches of both plants appear to be of indeterminate growth i.e. they are not of uniform length as are those of mature plants grown in natural conditions. In this respect they could be regarded as "weak" innovations. It should also be noted that the leaves of the plant shown in Figure 1b are very small and that the main axis of neither this plant nor that shown in Figure 1c shows any sign of developing a capitulum.

The plant shown in Figure 1d was grown in 0.006S solution through which 0.5% CO_2 was bubbled. At about 0.17 mg l^{-1} the concentration of nitrogen is probably about half that generally available to *Sphagnum cuspidatum* in natural ombrotrophic conditions (Riis & Sand-Jensen 1997, Wright *et al.* 1980). Unlike the plants shown in Figures 1b and 1c, this one closely resembles those that can be found in the field. It has produced several branches that can truly be regarded as innovations as they terminate in capitula and also support

branches of limited growth i.e. fascicular branches. For present purposes these innovations will be referred to as "strong" innovations to differentiate them from those produced by the plants shown in Figures 1b and 1c.

Capsules can only be collected at a certain time of the year and the spores do not remain viable for more than a few months. In order that experiments could continue the apices were removed from shoots in a completed experiment and used in similar treatments in another experiment. The resulting shoots will be referred to as "second generation" plants. Apices taken from such plants and used in subsequent experiments are "third generation" plants.

It was noticeable that whereas, in the more concentrated solutions, "primary" shoots (those grown directly from protonemata) produced only weak innovations second generation shoots produced both weak and strong innovations. The mean number of innovations of each type produced by second generation shoots grown for five weeks in solutions of various concentrations are shown in Table 1. The totals are also expressed as innovations per fascicle. The higher the concentration of the nutrient solution the greater is the number of innovations of each type that are produced.

In a subsequent experiment the effect on the production of fascicles and innovations by second generation shoots of reducing the concentration of nitrogen, phosphorus and potassium singly and in combination from that present in 0.03S solution to that in 0.003S was also investigated (Baker & Boatman 1990). Reducing the concentration of phosphorus alone resulted in somewhat fewer innovations being produced but when nitrogen was reduced alone or in combination with other nutrients dramatically fewer were produced. The number of fascicles produced was of a similar order in all treatments. It is important to note that while the concentrations of nitrogen used approximately covered the range found in natural conditions the concentrations of phosphorus were invariably considerably higher. In natural conditions, therefore, the concentration of phosphorus rather than nitrogen might be the factor limiting innovation production.

In an experiment using third generation shoots, which ran for 11 weeks, the total number of strong innovations produced by the five plants in 0.006S solution was only four while in 0.03S solution nine were produced. Altogether only 3 weak innovations were produced in the 0.006S solution and 5 in the 0.03S solution. All were located at the very base of the main axes. The five plants grown in 0.03S solution are shown in Figure 2.

The shoot tips used at the start of this experiment were small capitula so it is possible that once capitula have been formed they exert control over the growth of lateral branches otherwise more weak innovations would have been expected on the plants grown in 0.03S solution (cf. Table 1). In this connection it is of interest to note that, according to Ligrone and Duckett (1998), the extension of mature shoots of *Sphagnum* occurs by a process that is unique among mosses. Normally in mosses stem extension occurs as a consequence of the division of cells at the apex and their subsequent vacuolation when they are mature. In *Sphagnum*, however the vacuoles are resorbed after a period of time and the cells divide again producing axially arranged files of up to nine cells which subsequently elongate as they again vacuolate. It is this last process that brings about extension of the stem whereas the formation of branch initials presumably occurs before the first vacuolation process.

TABLE 1.
Innovation formation by second generation shoots of *S. cuspidatum* in various nutrient solutions

Solution Conc.	**Mean Fascicles Per Shoot**	**Mean Number of Innovations Per fascicle**	**Per shoot**	
			Weak	**Strong**
0.003S	16	0.04	0.6	0
0.006S	26	0.35	7	2.5
0.03S	26	1.26	28	5

FIGURE 2.
Third generation shoots (see text) grown for 11 weeks in 0.03S solution and 0.5% CO_2.

NUTRIENT SUPPLY AND THE FORM OF LEAF CELLS

It has been mentioned that the leaves of *Sphagnum* consist of two types of cell, hyaline and chlorophyllous cells. Normally the hyaline cells are longer and broader than the chlorophyllous cells and the walls are supported internally by rings of thickening (Fig. 3a). The chlorophyllous cells separate neighbouring hyaline cells. Attention has also been drawn to the small size of the leaves of plants grown in a relatively concentrated nutrient solution (0.1S – see above) through which air was bubbled. The cell structure of a leaf from one of these plants is shown in Figure 3b. In this case the hyaline and chlorophyllous cells are about the same width and are relatively short. Also the rings of thickening in the hyaline cells are relatively poorly developed and the chloroplasts in the chlorophyllous cells are much more conspicuous than in those of the field plant (Fig. 3a). In some cases the chloroplasts seem to be deteriorating and it is believed that these are developing into hyaline cells.

The results of an experiment conducted to investigate in more detail the effect of varying the concentrations of both CO_2 and mineral nutrient concentration on the lengths of hyaline and chlorophyllous cells are shown in Figure 4. Each value is the mean of eighteen measurements. The lengths of both types of cell tend to increase as the concentration of CO_2 is increased but less so in the more concentrated solution. The apparent shorter length of the chlorophyllous cells in 0.003S solution + 0.5% CO_2 compared with 0.003S +0.25% CO_2 could be a consequence of longer cells having divided. There might be a limit to the ability of these cells to extend. The effects of varying the concentrations of nitrogen, phosphorus and potassium singly and in combination on mean hyaline cell length are shown in Figure 4: it can be seen that while the cell length is somewhat affected by the concentration of phosphorus the effect of nitrogen concentration is much greater.

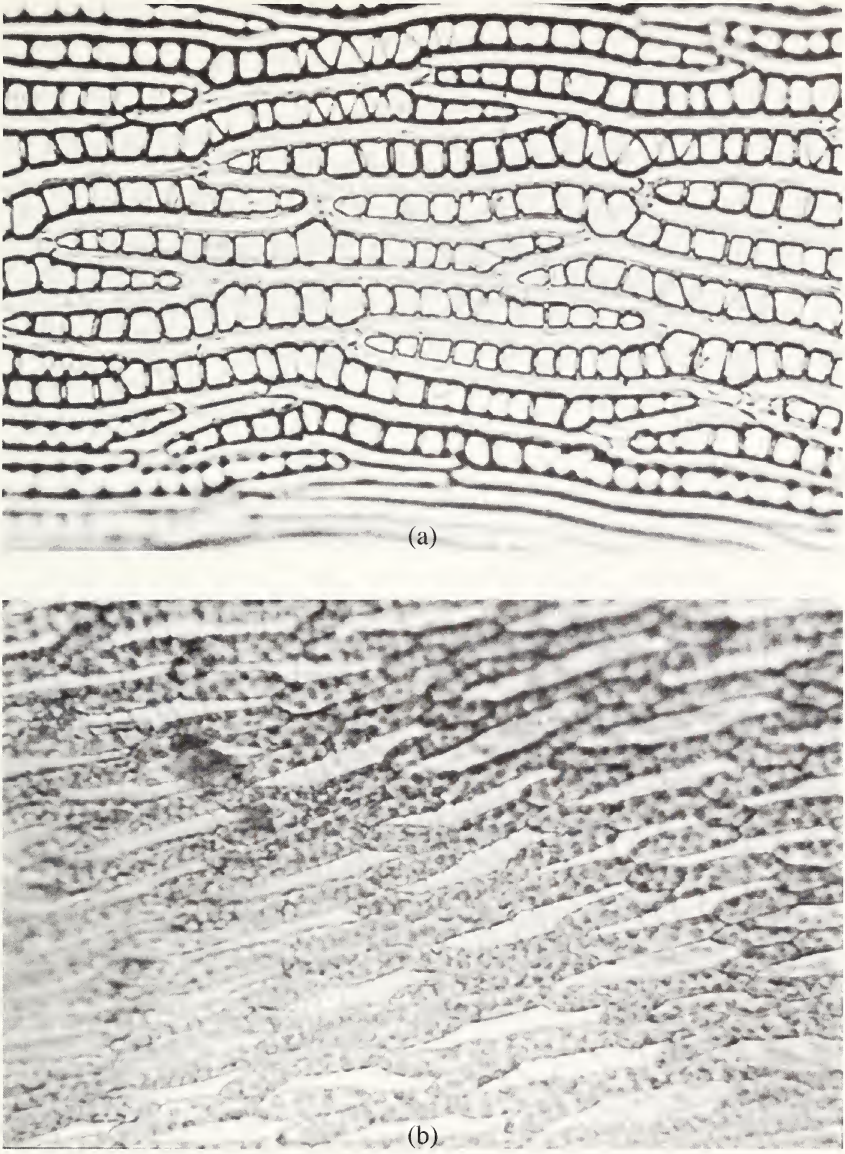

FIGURE 3.
Surface view of leaf cells of *Sphagnum cuspidatum* (a) from a plant growing naturally (b) from the plant shown in Figure 1(a).

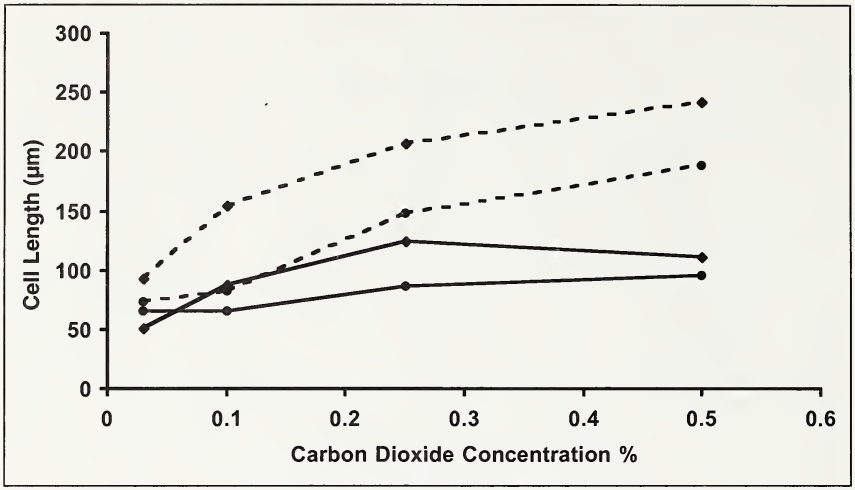

FIGURE 4.
Effects of mineral nutrient and carbon dioxide concentrations on the lengths of hyaline cells (dashed lines) and chlorophyllous cells (continuous lines); solid circles: 0.03S solution, solid diamonds: 0.003S solution.

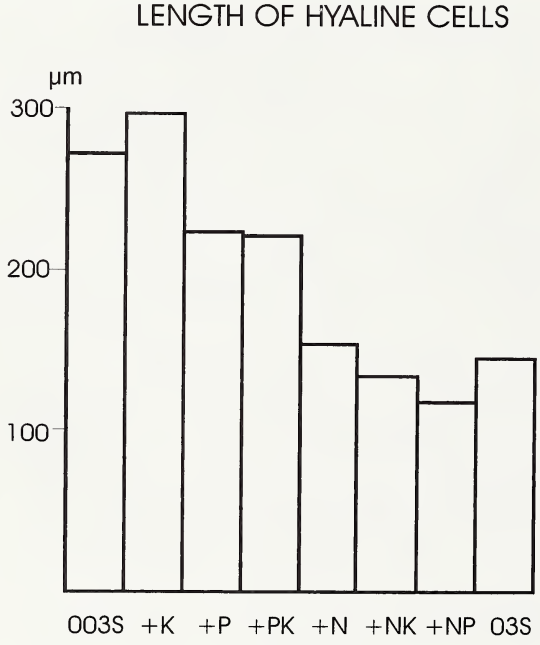

FIGURE 5.
Effects of varying the concentration of nitrogen, phosphorus and potassium, singly and in combination, on the mean length of hyaline cells.

Form and Function in *Sphagnum*

In the early years of plant ecology there was a considerable amount of interest in the extent to which certain morphological features were adaptations to enable plants to survive unusually harsh environmental conditions. Thus Watson (1918) points out that many of the morphological features exhibited by *Sphagnum* species would, in other mosses, "be considered as of a xerophytic nature enabling the plant to endure periods of drought". Tansley (1939), referring to Watson's work, expresses the view that different species "possess xeromorphic characters in greater or less degree" and that "the more aquatic species are least xeromorphic and least able to resist desiccation". This implies that the function of the xeromorphic characters is to conserve water and protect the plants against desiccation.

Watson himself, however, considered it was "difficult to reconcile the general watery habitat of *Sphagnum* with the presence of characters which, in other mosses, act as xerophytic devices". The degree to which xeromorphic characters are exhibited varies from one species to another and, because the correlation between the distribution of species and wetness is not very close, he considers that "there must be other factors influencing distribution besides degree of wetness and the most important of these is the acidity of the solution". The ability of *Sphagnum* species to acidify poorly buffered solutions is well known and the process by which it occurs is discussed in detail by Clymo (1963).

Watson also points out that the concentration of mineral salts in the habitats occupied by *Sphagnum* species is very low and consequently that there is a need for frequent supplies of fresh water. On plants living in exposed conditions for example the capillaries formed between the pendent branches of the fascicles and the stem draw up water from below and the flow of solution is aided by transpiration from the chlorophyllous cells and evaporation from the hyaline cells. Watson suggests that the "xerophytic devices" serve to replenish water supplies rapidly after periods of drought and thus also flush away excessive acid.

It should be stressed that Watson's views are derived entirely by comparing the morphology of different species growing in different habitats. No experimental evidence is provided to support any of his views.

An interesting observation made by Watson is that in some submerged species, notably *Sphagnum obesum* (= *S. auriculatum*) and *S. riparium*, hyaline cells are reduced or replaced by chlorophyllous ones. He also observes that "in a submerged form of *S. imbricatum* chlorophyllous cells are so much broadened that hyaline cells sometimes seem to be absent". Both *S. auriculatum* and *S riparium* can often be found in marshes, fens and flushes where nutrient availability is higher than in ombrotrophic conditions. It could be argued, therefore, that the reduction of hyaline cell development is a response to mineral nutrient availability especially as it has been shown experimentally that *S. cuspidatum* responds similarly when exposed to nutrient concentrations substantially higher than it experiences naturally.

A consequence of the development of hyaline cells is that the whole of the surface of the chlorophyllous cells rather than about 50% i.e. the upper and lower surfaces, is exposed to the surrounding medium. This, it is to be expected, increases the efficiency of nutrient absorption by these cells. Lengthening of the cells at low nutrient levels, as has been shown to occur experimentally (Fig. 3), will have a similar effect. Thus the development of hyaline cells could be an adaptation which enables the remaining live cells to survive in conditions of very low nutrient availability.

It must be noted that, in experimental conditions, well-developed hyaline cells were formed only when a gas mixture containing a greater concentration of carbon dioxide than that present in air was supplied. Yet large hyaline cells are present in the leaves of plants growing in ombrotrophic pools. The author is not aware of any determinations of carbon dioxide concentration in such pools but Riis and Sand-Jensen (1997) showed that the concentration of carbon dioxide close to the bottom of a lake in Denmark, where *Sphagnum subsecundum* was growing, was very much higher than further up the profile. The source of this was decomposing organic matter. Presumably *Sphagnum* growing in bog

pools receives an enhanced supply of carbon dioxide from a similar source.

In a *Sphagnum* leaf the chlorophyllous cells form a network which, in effect, branches and radiates out from the base of the leaf. From the base of a fascicular branch a core of parenchymatous cells passes through the outer layers of the stem to the central parenchyma (Schimper 1898). Using a radioactive isotope, Rydin and Clymo (1989) were able to show that phosphorus can move towards the apex of a *Sphagnum* stem internally and Aldous (2002) claims that nitrogen can be translocated internally as well. Thus it seems possible that, in nutrient-poor conditions, nutrients in the chlorophyllous cells of the leaves could be transferred to the leaf base via the network and thence into the branch, stem and stem apex.

Another feature of the *Sphagnum* shoot on which the concentration of mineral nutrients appears to have a profound effect is the form of the stem apex. In natural conditions this terminates in a capitulum, a cluster of developing branches, but in an experiment where a high concentration of mineral nutrients (0.1S) were supplied a capitulum failed to develop (Fig. 1c). Unfortunately it is not known whether this form can be perpetuated indefinitely as, in the only experiment undertaken, only "primary" shoots i.e. those growing directly from the protonema, were used.

The structure of the capitulum is such that rain falling on exposed plants is funnelled down towards the stem apex thus delivering the nutrients it contains directly to the growing leaves, branches and stem. When the nutrient concentration is very low this feature could have considerable survival value. According to the work of Ligrone and Duckett (1998), the feature is produced by a unique form of stem growth. In his field experiments using plants from a swallow hole and an ombrotrophic pool, Boatman (1977) found that the dry weight of the uppermost 50 mm of the former was considerably lower that of the latter. This was principally a consequence of the size of the capitula. After the plants from the swallow hole had been allowed to grow in the ombrotrophic pool for a period of several months the dry weight of the upper 50 mm had increased considerably suggesting that the growth mechanism can be affected by nutrient concentration to some extent.

Overall the experiments described above indicate that the morphological features which together render the genus *Sphagnum* unique among the Bryophyta have a considerable degree of plasticity and, when exposed to extreme conditions rarely experienced in Nature, can be prevented from developing altogether, at least temporarily. Naturally they are exhibited in an extreme form in conditions of very low nutrient supply. It is worth noting that the morphology of the great majority of algae growing in fresh water is such that the maximum surface area is exposed to the surrounding medium thus maximising the efficiency of nutrient absorption. It is believed that *Sphagnum* has adopted a similar policy but furthermore that the "xerophytic devices" exhibited by plants growing naturally ensure that an adequate supply of nutrients is delivered to the meristem at the stem apex thus enabling the plant to survive and continue growth.

Acknowledgements

The author wishes to express his gratitude to Dr R. G. E. Baker for permission to use material from his PhD thesis and also for the time spent on a number of discussions about matters relating to *Sphagnum* morphology.

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BOOK REVIEW

Handbook of Evolution Volume 1. The Evolution of Human Societies and Cultures edited by **Franz M. Wuketits** and **Christoph Antweiler**. Pp. xi + 341, with diagrams. Wiley-VCH Verlag, Weinheim. 2004. £125.00 hardback.

In at the deep end! Two forthcoming volumes are *The Evolution of Living Systems (including Hominids)* and *From the Origin of the Universe to the Origin of Life*. This expensive book, with its bibliographical 'goldmines', comprises eight chapters, and a preface commencing with a quotation from Theodosius Dobzhansky – "Nothing in biology makes sense except in the light of evolution". Subjects include evolution of cognition, language, societies, morality, politics, economics, and scientific method. There is one biologically based chapter, 'The Human Adaptation for Culture', where similarities and differences between the behaviours and cognitive abilities of humans and other primates are discussed (potato washing by Japanese macaques, chimpanzee tool-use, etc.), but even here (as the author, Michael Tomasello, acknowledges) there is a problem: 'it is easy to observe a human behaviour and posit a specific gene for that behaviour with no research into the genetics of the situation'. Likewise, as John M. Gowdy mentions in his economics chapter, the lack of a gene equivalent is a problem that has plagued theories of economic evolution for decades.

This reviewer found much of the book interesting, although certainly not easy reading, and would go along with Gowdy (quoting Franz Wuketits) – 'understanding the connenctions between markets and ecosystems, and between evolutionary theories in economics and biology is fundamental to understanding how we got to where we are today, and assessing our prospects for the future'. The problem of making *evolutionary* connections (i.e. involving natural selection) in a book devoted to societies and cultures is exemplified by Camilo J. Cela-Conde and Francisco J. Ayala in their chapter on morality: 'It is very difficult to escape circular arguments that consider very adaptive those moral patterns that survive solely because they manage to do so'.

DJH

THE WASPS AND BEES (*HYMENOPTERA: ACULEATA*) OF YORK'S VICTORIAN CEMETERY IN WATSONIAN YORKSHIRE

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York's Victorian Cemetery is a good site for species of aculeate wasps and bees with 70 recorded and one vagrant species including two species of national importance and five species of regional importance. The vagrant species is the Potter Wasp, *Eumenes papillarius* (Christ), which is not a British species but is found on mainland Europe just across the English Channel. This vagrant species will not be included in any further data analysis.

The Cemetery (SE 612508) was started in 1837 and gradually expanded to its present size of 9.7 ha. The Company managing the Cemetery went into liquidation in 1944 and the Cemetery was stripped of its assets. Since neither individual people nor York City Council was willing to undertake the management of the Cemetery, it became overgrown. In 1984, a group of local people formed the York Cemetery Trust. The Trust bought the Cemetery from Crown Commissioners for a nominal sum in 1987. A grant was obtained from York City Council so that the Trust could employ a full-time warden. An ecological land management scheme was put into operation by Askham Bryan Horticultural College, which allowed the development of natural flora and habitats alongside ornamental trees and shrubs. A Butterfly Walk rich in nectar and pollen producing plants was created in front of a high wall which is warmed by the sun. A rockery and herb garden were also established. Dead wood was left in sunny and shaded places. In excess of 83 herb and 32 tree and shrub species have been recorded from the Cemetery (records held by York Cemetery Trust). Many of these herbs, e.g. yarrow, white dead nettle, dandelion, shrubs, e.g. bramble, buddleia, tansy, and trees, e.g. hawthorn, sycamore, are important pollen and nectar sources for the wasps and bees besides providing the prey needed by the wasps as a food resource for their larvae. Holes in the dead wood in sunny situations and crevices in the wall are important nesting sites for the aerial-nesting solitary wasp and bee species.

Methods

Between 1995 and 2002, 34 visits were made to the Cemetery distributed throughout the year as follows: March (1 visit), April (3), May (9), June (7), July (7), August (6) and September (1). All the visits were made during warm sunny weather. Each visit usually lasted up to two hours when all species of aculeate wasps and bees were recorded and usually collected with a hand net for identification.

In the following account, the nomenclature can be related to that of Kloet and Hincks (1978). An up-to-date checklist can be found on the Bees, Wasps and Ants Recording Society (BWARS) web pages at http://www.bwars.com.

Species present and seasonal progression of species

A full list of recorded species is given in Appendix A. Table 1 shows the taxonomic distribution of species and records. A record represents a specimen differing in one of the following three variables: name, sex and day of visit. The wasp family, Sphecidae, is the dominant solitary wasp taxon in terms of number of species and records although both the Chrysididae and Eumeninae are well represented as records. All the five solitary bee subfamilies are well represented either in terms of species and/or number of records. The subfamily with the most species is Halictinae and Colletinae has the most records.

As a rough guide, any site in Watsonian Yorkshire with over 60 aculeate wasp and bee species can be considered a good site; sites with more than 80 species are very good, and those with more than 100 species are excellent. York's Victorian Cemetery is, therefore, a

TABLE 1
Number of species and records of aculeate wasps and bees from York's Victorian Cemetery

	No. species	No. records
Solitary wasps		
Chrysididae	3	15
Sapygidae	1	6
Pompilidae	2	3
Eumeninae	5	23
Sphecidae	14	47
Total solitary wasps	25	94
Solitary bees		
Colletinae	4	54
Andreninae	6	34
Halictinae	9	45
Megachilinae	6	49
Anthophorinae	5	30
Total solitary bees	30	212
Total solitary species	55	306
Social wasps and bees		
Vespinae	4	
Apinae	11	
Total social wasps and bees	15	
Total wasp and bee species	70	

good site. Since there is no other urban site that can be compared with the Cemetery it can stand as a standard for comparison with other sites that might be investigated in the future. Good rural sites are Burton Leonard Lime Quarries, Cave Wold and Cornelian with Cayton Bay. Since Burton Leonard Lime Quarries and Cornelian Bay with Cayton Bay are SSSIs, York's Victorian Cemetery must be considered, at least, to be a wildlife area of regional importance.

Table 2 shows the average number of solitary species recorded during each visit for each month. June and July were the best months with an average of about eleven species recorded per visit. The average of species recorded for all visits was exactly eight species.

TABLE 2
Number of species of solitary wasps and bees recorded per month at York's Victorian Cemetery

	No. visits	No. species	Species per visit
March	1	1	1.0
April	3	8	2.7
May	9	71	7.9
June	7	78	11.1
July	7	72	10.3
August	6	39	6.5
September	1	3	3.0

June and July were the best months for recording solitary wasp species, with May and June the most productive months for first recording of species (Table 3). The most frequently species found, which were all aerial nesters or parasites of aerial nesters, were the mason wasps, *Ancistrocerus gazella* and *A. oviventris* with their parasites *Chrysis ignita*

TABLE 3
Number of species and first records of species of solitary wasps and bees recorded per month at York's Victorian Cemetery

	March	April	May	June	July	August	September
Solitary wasps							
First records	0	1	8	11	3	2	0
Recorded	0	1	9	18	14	9	2
Solitary bees							
First records	1	4	12	7	2	4	0
Recorded	1	5	17	20	15	14	1

and *C. impressa*; the sphecid wasps *Crossocerus annulipes, C. elongatulus, Ectemnius cephalotes* and *E. cavifrons*; and the cleptoparasite *Sapyga quinquepunctata* whose hosts are mason bees of the genus *Osmia*. The cleptoparasite female of *S. quinquepunctata* enters the nest of its host and lays an egg on or near the egg of its host probably using its sting to penetrate the cell wall. On hatching, the first instar larva, which has large mandibles, eats the egg of the host. Later instars have smaller mandibles and feed on the stored food of the host. The mason wasps with their parasites and the sapygid were usually associated with the Cemetery wall and the sphecids *Ectemnius* and *Crossocerus annulipes* were usually associated with dead wood in sunny places. *Crossocerus elongatulus* is usually a subterranean nester but it also nests in crevices in old brick walls and was usually associated with the wall.

May to August were the best months for recording solitary bee species, with May and June the most productive months for first recording of species (Table 3). The species most frequently recorded were both subterranean and aerial nesters and were usually found on flowers collecting pollen and/or nectar or sunning themselves on the tombstones. The sunning species were the sweat bees, *Lasioglossum cupromicans, L. smeathmanellum* and *L. albipes*, and the yellow-faced bees, *Hylaeus hyalinatus* and *H. communis*. The mason bees, *Osmia rufa, O. leaiana* and *O. caerulescens* were also associated with the wall in which they nested. The leaf-cutter bees, *Megachile centuncularis* and *M. willughbiella* were also associated with the dead wood in which they nested. Most of the subterranean nesters were only found on the flowers, as their nesting sites were not found. These subterranean nesters included *Colletes daviesanus, Halictus tumulorum, Andrena fulva* with its cleptoparasite *Nomada panzeri*, *A. haemorrhoa*, and *A. scotica* with its cleptoparasite *N. marshamella*. The cleptoparasites of *Colletes daviesanus* (*Epeolus variegatus*), *Andrena haemorrhoa* (*Nomada ruficornis*) and *Halictus tumulorum* (*Specodes* spp.) were not found which seems unlikely as the host species were so frequently found. Since cleptoparasites are often associated with the nest sites of their hosts, perhaps the hosts were using the Cemetery for foraging but nesting away from the Cemetery so decreasing the chances of finding their cleptoparasites.

SPECIES QUALITY OF THE SITE

Archer (2002) developed a regional quality scoring scheme for the solitary species based upon four statuses: Common, Frequent, Occasional and Rare. The Common and Frequent status species may be considered the low quality species and the Occasional and Rare status species the high quality species. Six high quality species have been recorded from the Cemetery including one species with a rare status, *Crossocerus distinguendus*, and five species with occasional status, *Sapyga quinquepunctata, Hylaeus signatus, Andrena denticulata, Megachile versicolor* and *Anthophora furcata*. None of the social species may be considered as high quality species.

Two recorded species are of national importance, *Hylaeus signatus* (Falk 1991) and *Crossocerus distinguendus* (BWARS, in press) which was only recorded recently for the first time in Kent but it has now started to extend its range. The record from the Cemetery was the first record of this species from Watsonian Yorkshire.

Archer (1999, 2002) has developed a national quality scoring scheme for the solitary species based on six statuses: Very rare, Rare, Scarce, Restricted, Widespread and Universal. Species with a very rare, rare or scarce status are high quality species while species with a restricted, widespread or universal status are low quality species. *Crossocerus distinguendus* and *Hylaeus signatus* are high quality species with a scarce status. By giving each of the 55 solitary species an Archer national quality status a national quality score of 82 can be calculated (Table 4) with a national species quality score (SQS) of 1.5 (82 divided by the 55 solitary species).

How does this SQS compare with SQSs from other Watsonian Yorkshire sites? Archer (2003) divided the SQSs of studied Yorkshire sites into three classes as follows: first class 2.4-2.9; second class 1.8-2.3; and third class 1.2-1.7. York's Victorian Cemetery is a third class site mainly because most of the recorded species have national universal or widespread statuses. Other third class sites are Skipwith Common, Burton Leonard Lime Quarries, Cayton to Cornelian Bay and South Cliffe Common. As such, again York's Victorian Cemetery must be considered, at least, of regional importance.

TABLE 4
Archer national quality scores of the solitary species recorded from York's Victorian Cemetery

Status	Status score (A)	No. species (B)	Quality score (A x B)
Universal	1	40	40
Widespread	2	13	26
Restricted	4	0	0
Scarce	8	2	16
Total		55	82

Species Quality Score (SQS) 82/55 = 1.5.

ESTIMATING THE POTENTIAL NUMBER OF SOLITARY WASP AND BEE SPECIES

One of the problems in the study of any site is the difficulty of not knowing how many more are present at a site, but, as yet, are unrecorded. Recent advances in non-parametric statistical procedures offer a way of addressing this problem. The presence/absence estimate of Chao (in Colwell & Coddington 1994) is based on the number of species that are observed in one (unique species) or two samples or visits. Because some species are only active in the spring or summer it is advisable that samples be taken throughout the months of adult activity. The software to carry out the statistical procedure was provided by Pisces Conservation Ltd.

The statistical procedure was run 34 times, equivalent to the number of samples. The software takes 1, 2, etc. samples at random 34 times, each time calculating a mean estimate of species diversity. With a small number of samples the estimates are erratic, but as more samples are selected the estimates may stabilise giving confidence in the estimates. In fact, the estimates do stabilise (Fig. 1) predicting that about 64 solitary species potentially could be present on the site. The estimate is given in Table 5 for the maximum sample size with its 95% confidence limits (meaning that there is a 95% chance that potential number of species falls within this range). Further about 86% of this potential number of species has been recorded.

Since the Chao estimator is a relatively new statistical procedure, caution is needed in accepting its estimates. Two further non-parametric statistical procedures are the first order Jackknife (Heltshe & Forrester 1983) and the Bootstrap (Smith & van Belle 1984)

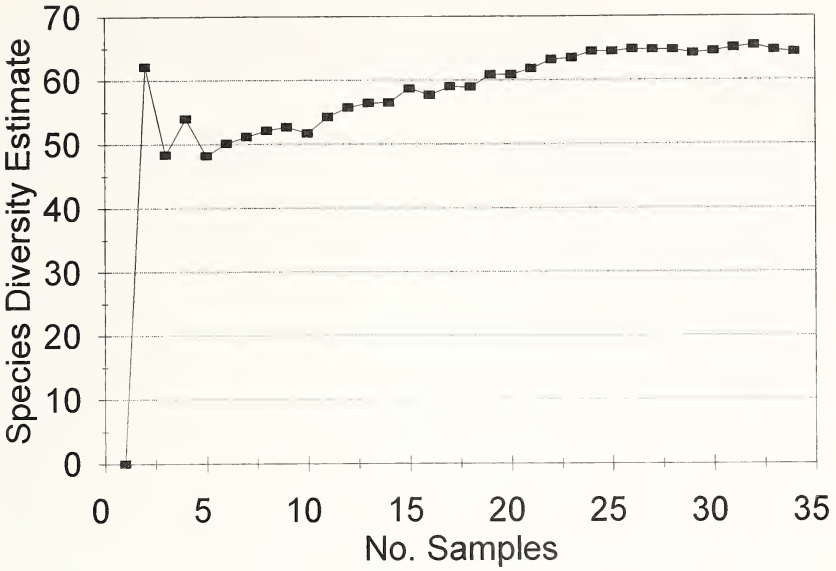

FIGURE. 1.
Chao presence/absence estimates of species richness of solitary wasps and bees from York's Victorian Cemetery

procedures (software by Pisces Conservation Ltd.). The Jackknife procedure depends only on the unique species and the Bootstrap procedure on the proportion of samples containing each species. Both these procedures, with increasing sample size, closely approach an upper asymptote value indicating a stabilised prediction (Figs 2 & 3). The Jackknife procedure gives a slightly higher estimate of 68 species and the Bookstrap a slightly lower estimate of 61 species compared with the Chao estimate. However, the Jackknife and Bootstrap estimates are included within the 95% confidence limits of the Chao estimate so that the estimates are in general agreement and confidence can be placed on the use of these relatively new statistical procedures. The use of these three procedures with several data sets also usually shows the Jackknife estimate to be slightly greater and the Bootstrap estimate slightly less, than the Chao estimate.

TABLE 5
Non-parametric estimates of species richness of solitary wasps and bees from York's Victorian Cemetery

	Chao	Jackknife	Bootstrap
Number of species			
– recorded	55	55	55
– estimated	64	68	61
95% confidence limits of estimates	53-76	60-75	
% of species recorded	85.9	80.9	90.2

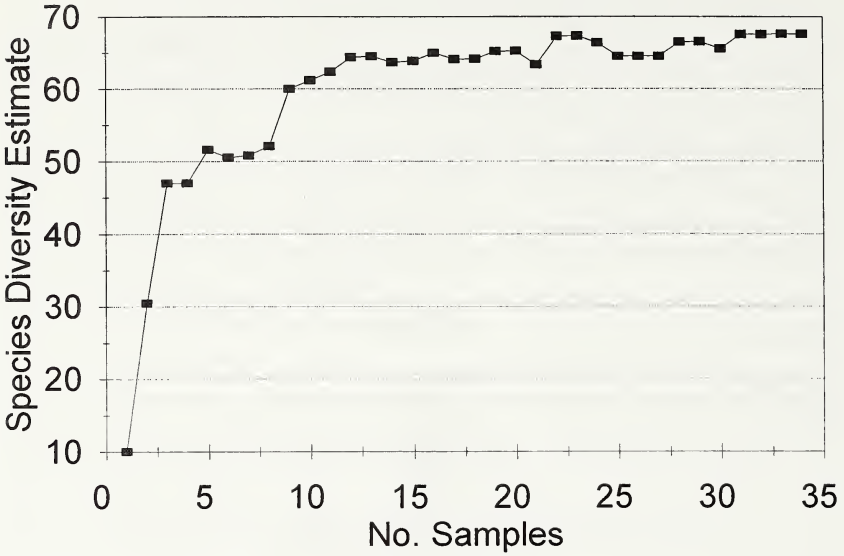

FIGURE. 2.
Jackknife estimates of species richness of solitary wasps and bees from York's Victorian Cemetery

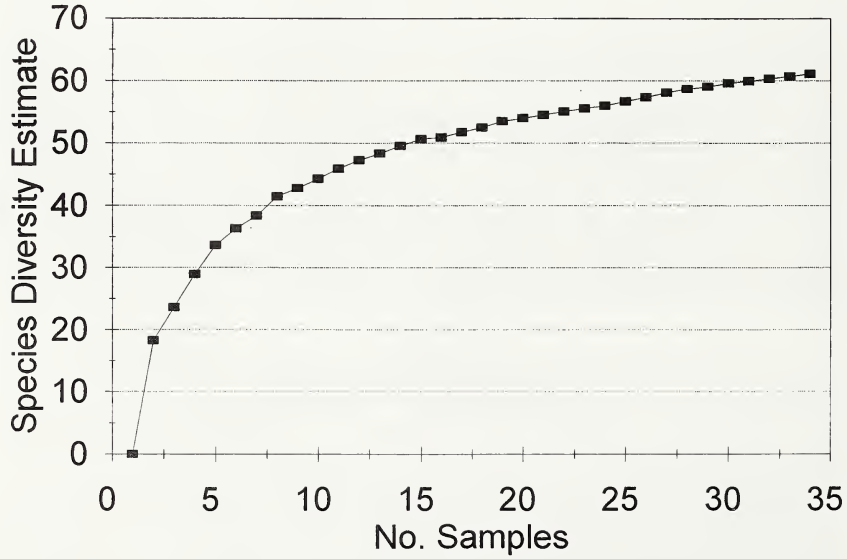

FIGURE. 3
Bootstrap estimates of species richness of solitary wasps and bees from York's Victorian Cemetery

COMPARISONS WITH OTHER SITES

Since the species diversity investigations have shown stable estimates for the Cemetery it is possible to compare it with other sites. These will be made with respect to the areas of sites, cleptoparasitic loads and aerial nester frequencies.

Species-area Relationships

The number of solitary species can be related to site area. The species-area relationship can be found by plotting the number of solitary species recorded at a site against the area of the site, with both the number and area expressed as natural logarithms (ln). Archer (2003) showed a species-area figure for 28 sites from the north and north Midlands of England. The dot for York's Victorian Cemetery (ln 2.27 area versus ln 4.01 solitary species) falls within the dots for the 28 sites, indicating that the Cemetery has the number of species that might be expected in terms of its area.

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasitic (or parasitoids) on other host aculeates. Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasitic rates are higher in temperate regions, as host populations are more synchronised in their life-history characteristics than in tropical regions. This finding probably does not hold for desert regions where the occurrence of rainfall would tend to synchronise life-history characteristics. From a review of the literature Wcislo found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%.

For 27 sites from north and north Midlands of England, the author found that CLs for solitary bees vary from 22.5%-40.0% giving a range of 17.5% (Archer 2003), which is very close to the range found by Wcislo. The CL for solitary bee species from the Cemetery (Table 6) is low, in falling outside this range. Since cleptoparasites are often associated with the nest sites of their host and if their hosts, which are subterranean nesters, were nesting outside the Cemetery the cleptoparasites would tend not to be found so lowering the CL.

Wcislo gave no CLs for solitary wasps but from 28 sites from north and north Midlands of England CLs vary from 10.3%-24.4% giving a range of 14.1% (Archer 2003). The CL for the solitary wasp species (Table 6) falls within this range. Unlike the subterranean nesting bees, the sites of the aerial nesting wasps were found so that their associated parasites were more likely to be found.

TABLE 6

Relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species from York's Victorian cemetery

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic Load CL = 100 x C/(H+C)
Solitary wasps	21	4	16.0
Solitary bees	25	5	16.7

Aerial Nester Frequency

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters use old beetle burrows in dead wood, central stem cavities (e.g. bramble), crevices in old walls or exposed on the surface of rock or other hard material. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered.

The AFs for the solitary species are given in Table 7. The AFs for all the British species

of solitary wasps is 46.2% and solitary bees is 17.9%. The AFs of the solitary wasps and bees of the Cemetery are much higher than the British AFs and are amongst the highest AFs recorded for any Yorkshire sites (Archer 2003). These high values illustrate the importance of the wall and dead wood in sunny situations as aerial nesting sites.

TABLE 7
Nesting habits of the host species of solitary wasps and bees from York's Victorian Cemetery

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = 100 x A/(A+S)
Solitary wasps	17	4	81.0
Solitary bees	10	15	40.0

CONCLUSIONS ABOUT YORK'S VICTORIAN CEMETERY

1. It is a good site in terms of the number of recorded species (71) including the vagrant Potter Wasp, *Eumenes papillarius*, a particularly notable record.
2. It is a third class quality conservation site because most of the recorded species have a nationally Universal and Widespread status. Two species of national importance and six species of regional importance were found.
3. Three estimates of potential species diversity gave stable estimates and closely agreed with each other. It is estimated that 80-90% of the potential species have been recorded.
4. The species-area relationship indicates that for the area of the Cemetery the expected number of solitary species was recorded.
5. The cleptoparasitic load for solitary bees is low, probably because many of the subterranean nesters are nesting outside the Cemetery.
6. The aerial nester frequencies are very high indicating the importance of the wall and dead wood as nesting resources.

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APPENDIX A.
LIST OF SPECIES RECORDED

CHRYSIDIDAE: *Chrysis angustula* Schenck, *C. ignita* (L.), *C. impressa* Schenck.
SAPGIDAE: *Sapyga quinquepunctata* (Fab.).
POMPILIDAE: *Dipogon variegatus* (L.), *Anoplius nigerrimus* (Scopoli).
EUMENINAE: *Eumenes papillarius* (Christ), *Ancistrocerus gazella* (Panzer), *A. oviventris* (Wesmael), *A. parietinus* (L.), *A. parietum* (L.), *Symmorphus bifasciatus* (L.).
VESPINAE: *Dolichovespula sylvestris* (Scopoli), *Paravespula germanica* (Fab.), *P. vulgaris* (L.), *Vespula rufa* (L.).
SPHECIDAE: *Crossocerus annulipes* (Lepeletier & Brullé), *C. cetratus* (Shuckard), *C. distinguendus* (Morawitz), *C. elongatulus* (Vander Linden), *C. megacephalus* (Rossius), *C. nigritus* (Lepeletier & Brullé), *C. pusillus* Lepeletier & Brullé, *Ectemnius cavifrons* (Thomson), *E. cephalotes* (Olivier), *Rhopalum coarctatum* (Scopoli), *Mimumesa dahlbomi* (Wesmael), *Pemphredon inornata* Say, *P. lugubris* (Fab.), *Mellinus arvensis* (L.).
COLLETINAE: *Hylaeus communis* Nylander, *H. signatus* (Panzer), *H. hyalinatus* Smith, *Colletes daviesanus* Smith.
ANDRENINAE: *Andrena denticulata* (Kirby), *A. fulva* (Müller *in* Allioni), *A. haemorrhoa* (Fab.), *A. nigroaenea* (Kirby), *A. semilaevis* Pérez (=*saundersella*), *A. scotica* Perkins.
HALICTINAE: *Halictus rubicundus* (Christ), *H. tumulorum* (L.), *Lasioglossum albipes* (Fab.), *L. calceatum* (Scopoli), *L. cupromicans* (Pérez), *L. leucopus* (Kirby), *L. smeathmanellum* (Kirby), *L. villosulum* (Kirby), *Sphecodes geoffrellus* (Kirby).
MEGACHILINAE: *Osmia caerulescens* (L.), *O. leaiana* (Kirby), *O. rufa* (L.), *Megachile centuncularis* (L.), *M. versicolor* Smith, *M. willughbiella* (Kirby).
ANTHOPHORINAE: *Nomada fabriciana* (L.), *N. goodeniana* (Kirby), *N. marshamella* (Kirby), *N. panzeri* Lepeletier, *Anthophora furcata* (Panzer).
APIDINAE: *Bombus hortorum* (L.), *B. lapidarius* (L.), *B. lucorum* (L.), *B. pascuorum* (Scopoli), *B. pratorum* (L.), *B. terrestris* (L.), *B. bohemicus* (Seidl), *B. campestris* (Panzer), *B. sylvestris* (Lepeletier), *B. vestalis* (Geoffroy *in* Fourcroy), *Apis mellifera* L.

ENTOMOLOGICAL REPORT
DIPTERA: TIPULOIDEA AND EMPIDOIDEA

ROY CROSSLEY

Introduction

The last report covering these two Superfamilies was published in 2003 (*Naturalist* **128:** 59-64). Since then much recording has continued to be undertaken across the County, and the more significant additions are noted below. A recent examination of specimens collected by Kenneth Payne in the 1950s has revealed a number which were not published as records at the time and it is a great pleasure to rectify the omissions now. Likewise the nationally important record of *Dolichocephala thomasi* from Malham has not been published previously and I am grateful to Dr Irwin for allowing me to do so here.

As always, it is a pleasure to acknowledge the assistance of many colleagues, especially P. J. Chandler for much help with *Symplecta chosenensis*; and those who have submitted records, including P. Boardman, J. D. Coldwell, W. A. Ely, A. Godfrey, D. J. Heaver, K. G. Payne, P. Skidmore and A. E. Stubbs; unattributed records are those of the writer. New County records are indicated by †, and Vice-County records by *.

The national rarity classifications which follow, where appropriate, immediately after the species names, are those provisionally recommended by Falk (1991) for Tipuloidea, and by Falk and Crossley (in prep.) for Empidoidea.

The systematic order of the following list, and nomenclature, follow Chandler (1998).

TIPULIDAE

Prionocera pubescens Lw. RDB2 (64) Austwick Moss, 27/5/2004 (1♂) P.B. The first Yorkshire record was from Austwick Moss 12/5/1938, and again in the following month (C. A. Cheetham). Cheetham further recorded it at Austwick 20/5/1947. Mr Boardman is to be congratulated on his recent re-discovery, which confirms the continuing occurrence of this nationally rare species at its only known Yorkshire site. I am indebted to him for his generous donation of the voucher specimen for safe keeping in my collection.

*Tipula (*s.g. *Savtshenkia) grisescens* Zett. RDB3 (65) Rake Beck, Feldom, 30/4/2003 (1♂). For a brief account of the history of this species in Yorkshire see Crossley (2003, p. 60).

T. (s.g. *Schummelia*) *yerburyi* Edw. Nb (62) East Moor Wood, Pockley, 5/7/2004. Examples of both sexes were found at the southern end of the wood, in the vicinity of overhanging low cliffs along streamsides. This constitutes the third locality for the species in the North York Moors National Park. For an account of previous Yorkshire occurrences see Crossley (2003 p.60).

PEDICIIDAE

Dicranota (s.g. *Paradicranota*) *simulans* Lacks. RDB3 (*62) East Moor Wood, Pockley, 15/6/2004, 1♂ by side of woodland stream; (65) Hack Fall Wood, Grewelthorpe, 10/7/2004 1♂ by woodland stream. The only previous authentic Yorkshire record for this species is from the riverside at Healaugh (65), 26/6/1981, P.S.

LIMONIIDAE

**Ellipteroides* (s.g. *Protogonomyia*) *alboscutellatus* (von Roser) RDB1 (65) Hack Fall Wood, Grewelthorpe, 10/7/2004. Widespread and numerous in wet areas of the wood. This nationally rare species was first recorded in Yorkshire at Whitewell in the extreme west of VC64, where specimens were found in 1958 and 1960 by the late Alan Brindle, a former President of the YNU. In 1997 it was reported from Ashberry and Forge Valley Woods NNR and it was found again at both these VC62 sites in 2003 (D.J.H.)

**Erioptera* (s.g. *Erioptera s.s.*) *verralli* Edw. RDB3 (65) Foxglove Covert, Catterick Garrison, 28/5/2003; Slapstone Holm Wood, Healaugh, 13/6/2003; Hack Fall Wood, Grewelthorpe, 18/5/2004. In all cases the habitat was shaded streamsides in woods.

Molophilus (s.g. *Molophilus s.s.*) *variispinus* Starý Nb (*62) Forge Valley Woods NNR, 15/6/1995; Mowthorpe Dale, 29/5/98; (65) Hack Fall Wood, Grewelthorpe, 18/5/2004. The only previous Yorkshire record is from Rowton Beck in the far north-west of VC65, 1♂ 20/6/1981 P.S.

†*Symplecta* (s.g. *Symplecta s.s.*) *chosenensis* (Alexander) (61) Reighton (= Speeton?) cliffs, 17/8/1988, A.E.S.; Sewerby Cliffs, 8/7/1997 (1♀); Reighton Cliffs, 20/7 & 1/8/2001, 26/7/2002 & 7/6/2003 (numerous examples of both sexes). Originally thought to be *S.* (*?novaezemblae* subspecies) *scotica* (Edw.), Dr Jaroslav Starý (Olomouc, Czech Republic), subsequently examined specimens and named them *'chosenensis'*. A full account of this addition to the British List, acknowledging our indebtedness to Dr Starý, is given in Chandler and Crossley (2003).

Eloeophila verralli (Bergroth) Nb (62) Bonfield Gill, Pockley, 3/6/2003, (1♀ by moorland stream); (*65) Calf Hall Wood, Richmond, 8/6/2004 (1♂ by river). There are only two Yorkshire localities from which this species has been previously recorded: Duncombe Park (62), on silty river bank below weir, 18/6/1983 P.S., and Whitewell (64) from larvae found in sand by the river, which emerged as adults during 1954 and 1955, with further records in 1957 and 1958, A. Brindle.

Atypophthalmus inustus (Mg.) Nb First recorded in Yorkshire in 1982 at Rushy Moor Wood (63), P.S., this species has now been found in ten widely scattered damp woodland sites in all five vice-counties. The most recent record is Hack Fall Wood, Grewelthorpe (65), 19/6/2004. The larvae develop within fungi (Falk 1991).

**Dicranomyia* (s.g. *Dicranomyia s.s.*) *aperta* Wahl. RDB1 (62) Sand Dale, 20/8/2003 and 6/9/2003. Numerous in calcareous flushes in association with Grass of Parnassus (*Parnassia palustris* L.). Cheetham recorded this species at Austwick, 4/9/1927 and again in 1930 and 1931, and from a site at Ingleton in 1934. An association with *P. palustris* has been noted in the past, and from my observations at Sand Dale it appeared that some of these tiny crane-flies were nectaring deep in the flower heads, but further research is necessary to establish this beyond doubt.

D. (s.g. *D. s.s.*) *distendens* Lundström Nb Since first being recorded in Yorkshire at Troutsdale Fen (62) in 1998 (Crossley 1999, p. 85), further specimens have been found at Seivedale Fen (Dalby Forest) 28/6/2004, and East Moor Wood, Pockley, 5/7/2004; both sites are also in VC62.

†*D.* (s.g.*Idiopyga*) *nigristigma* Nielsen (62) Ashberry, 25/8/1989 (1♂ and 1♀), A.E.S. This record, which has only recently come to light, is the first for the County of a species which was introduced to the British List in 1998 (Stubbs 1998). The record pre-dates by ten years that by John Coldwell for the Little Don Valley (63) and published as new to Yorkshire in Crossley (2000). Subsequent VC62 records are: Forge Valley Woods NNR, 1♀ 7/9/1996 (originally named *'stigmatica'* in error); Sand Dale, 6/9/2003; East Moor Wood, Pockley, 17/9/2003. There is a further report from Ashberry – 1♂, 8/8/2003 D.J.H.

Lipsothrix errans (Walker) Nb (65) Hack Fall Wood, Grewelthorpe, 18/5/2004. This scarce species was recorded by C. A. Cheetham and F. W. Edwards in the 1920s from Austwick and Ingleton, and Crag Wood, Rawdon. There is a further record from Whitewell, in the far west, in 1962, A. Brindle. Since 1995 it has been found in several quality woodland sites in the north-east, such as Forge Valley Woods NNR and Littlebeck Wood near Sleights. The only other VC65 record is from Cautley in 1927 (C.A.C.). Larvae of this genus develop in wet decaying timber (Falk 1991).

**Orimarga juvenalis* (Zett.) Nb (62) Sand Dale, 11/6/2003 and 1/7/2003, several in calcareous seepages. The only previous Yorkshire records are Norber, 26/6/1931 and Thieves Moss, 1/7/1935, both VC64 and both C. A. Cheetham.

EMPIDIDAE

†*Dolichocephala thomasi* Wagner (64) West Fen, Malham 26/8/1984, A.G. Irwin. Described by Wagner (1983), the first published records for this species in Britain relate to examples found at several Scottish sites between 1988 and 1991 (MacGowan 1996). This hitherto unpublished record pre-dates the Scottish ones and remains the only one for Yorkshire (and possibly the only English record).

Empis (s.g. *Euempis*) *picipes* Mg. (63*) Brockadale 2/6/1956, 1 ♂ K.G.P.; (64*) Angram (near Askham Richard) 10/5/1959, 4 ♂♂ K.G.P. First reported from Allerthorpe (61) by W. J. Fordham in 1926, all recent records have also been from VC61, including a sandy area on the chalk at Potter Brompton, lowland sands at Barmby Moor, and at Spurn.

**Hilara recedens* Nb (61) Millington Dale 23/6/2003. There is only one previous Yorkshire record for this species: Acaster Malbis (64) 1/6/1985.

DOLICHOPODIDAE

†*Achalcus bimaculatus* Pollet (62) Osbaldwick, York 9/6/2003, numerous in suction

samples in a damp meadow, A.G. See Crossley (1999) for comments on the recent revision of this genus and additional Yorkshire species.

**Rhaphium fasciatum* (65) Foxglove Covert, Catterick Garrison 28/5/2003; Muker, near the River Swale, 14/6/2003. A localised species with widely dispersed records, mostly across the north of Yorkshire. There are no records from VC63.

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BOOK REVIEW

Land Snails in the British Isles by **Robert Cameron** and illustrated by **Gordon Riley**. AIDGAP Occasional Publication 79. 2003. £8.95 (including postage) from: Field Studies Council, Preston Montford, Shropshire SY4 1HW.

The AIDGAP series of publications is well known for introducing students to difficult groups of animals and plants. The production of a dichotomous key to the land snails of the British Isles has always been considered difficult to construct. The inclusion of the very fine illustrations by Gordon Riley, most of them familiar to us from the *Collins Field Guide to the Land Snails of Britain and North-west Europe* by M. P. Kerney and R. A. D. Cameron, together with additional illustrations by Gordon Riley and Beata Pokryszko taken from the latter's *Monograph on the Vertiginidae of Poland*, greatly enhance the booklet. These and other illustrations, along with a series of linear keys, have resulted in a very accessible publication.

The test of a good key depends on its ability to separate out the more difficult groups, or pairs of species. Too often the compilers of keys attempt to use the same process throughout the key. In this publication, if a species or group of species will not key out using the dichotomous system, then the linear system is used instead, making it possible to determine most of the many varieties of shell form. On the whole, this is a very good publication, one that should become a 'must-have' requirement for all those interested in the identification of invertebrates. AN

AN ANNOTATED CHECKLIST OF THE ORTHOPTEROID INSECTS OF WATSONIAN YORKSHIRE

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Introduction

Orthopteroid insects comprise the Orthoptera (grasshoppers and allied saltatorial insects), Dictyoptera (cockroaches and mantises) and Dermaptera (earwigs). Of those species recorded as natives, established aliens and occasional migrants in the British Isles (*sensu* Marshall & Haes 1988), 30 are believed to have occurred in Watsonian Yorkshire (vice-counties 61-65). Two further species have been published in error. The comital status of the former group may not necessarily mirror their wider status, but Marshall and Haes' list provides a practical base-line for the present, from which future workers may begin a new and more adequate county list. No attempt has been made to collate an inventory of all exotic introductions in the county.

The first Yorkshire list, which covers species of all origins, was that of Porritt (1907). Marshall and Haes (1988), in their appendix of vice-county records, indicate a Yorkshire total of 25 species, the latter as defined above with two exceptions. These are that they omitted occasional migrants, and those essentially southern native species only recorded casually in Yorkshire. Also, one species of earwig was missed. The current list was initially issued as a 'working checklist' (Limbert 1999), but as it has since been suggested that it should be reissued in this slightly augmented form, it is presented as a broad overview of Yorkshire's orthopteroid fauna. It may also be regarded as a contribution to a future assay of the county's biodiversity. Nomenclature throughout follows Marshall and Haes (1988).

Annotated checklist of species

Orthoptera

Raphidophoridae

Tachycines asynamorus Adelung (Greenhouse Camel-cricket): Casual introduction.

Tettigoniidae

Conocephalus (Xiphidion) dorsalis (Latr.) (Short-winged Cone-head): Rare and localised resident.

Leptophyes punctatissima (Bosc) (Speckled Bush-cricket): Very rare and probably extinct resident and apparent casual introduction.

Meconema thalassinum (De Geer) (Oak Bush-cricket): Localised resident.

Metrioptera (Metrioptera) brachyptera (L.) (Bog Bush-cricket): Rare and localised resident.

M. (Roeseliana) roeselii (Hagenb.) (Roesel's Bush-cricket): Rare and localised resident.

Pholidoptera griseoaptera (De Geer) (Dark Bush-cricket): Very rare and localised resident.

Tettigonia viridissima L. (Great Green Bush-cricket): Casual introduction.

Gryllidae

Acheta domesticus (L.) (House-cricket): Established alien.

Gryllus campestris L. (Field-cricket): Casual introduction.

Gryllotalpidae

Gryllotalpa gryllotalpa (L.) (Mole-cricket): Extinct resident and apparent casual introduction.

Tetrigidae

Tetrix (Tetratettix) undulata (Sow.) (Common Ground-hopper): Frequent resident.

T. (Tetrix) subulata (L.) (Slender Ground-hopper): Rare and localised resident.

Acrididae

Chorthippus (Chorthippus) albomarginatus (De Geer) (Lesser Marsh Grasshopper): Localised resident.

C. (C.) parallelus (Zett) (Meadow Grasshopper): Frequent resident.

C. (Glyptobothrus) brunneus (Thunb.) (Field Grasshopper): Common resident.

Locusta migratoria (L.) (Migratory Locust): Rare migratory visitor (19th century invasions) and casual introduction.

Myrmeleotettix maculatus (Thunb.) (Mottled Grasshopper): Frequent resident.

[*Omocestus rufipes* (Zett.) (Woodland Grasshopper): Reported in error (Porritt 1907)].

O. viridulus (L.) (Common Green Grasshopper): Common resident.

Schistocerca gregaria (Forsk.) (Desert Locust): Very rare migratory visitor, or perhaps casual introduction.

DICTYOPTERA

Blaberidae

Pycnoscelus surinamensis (L.) (Surinam Cockroach): Casual introduction.

Blattidae

Blatta (Blatta) orientalis (L.) (Common or Oriental Cockroach): Established alien.

Periplaneta americana (L.) (American or Ship Cockroach): Established alien.

P. australasiae (Fab.) (Australian Cockroach): Established alien.

Blattellidae

Blattella germanica (L.) (German Cockroach): Established alien.

Supella longipalpa (Fab.) (Brown-banded Cockroach): Rare established alien.

DERMAPTERA

Anisolabididae

Euborellia annulipes (Lucas) (Ring-legged Earwig): Casual introduction.

Labiidae

Labia minor (L.) (Lesser Earwig): Infrequent resident.

Marava arachidis (Yersin) (Bone-house Earwig): Casual introduction.

Forficulidae

[*Apterygida media* (Hagenb.) (Short-winged or Hop-garden Earwig): Mapped erroneously in Haes and Harding (1997)].

Forficula auricularia (L.) (Common Earwig): Common resident.

ACKNOWLEDGEMENTS

In compiling the records which have resulted in the present list, I am grateful for the help of Andrew Grayson (Yorkshire Naturalists' Union recorder for orthopteroid insects), H. R. Arnold (Database Manager, Biological Records Centre, CEH Monks Wood) and J. P. Widgery (former organiser of the Orthoptera Recording Scheme for Britain and Ireland).

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Y.N.U. BRYOLOGICAL SECTION: ANNUAL REPORT 2002-2003

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Excursions

The following sectional meeting were held in 2002-2003.

Lower Gordale (VC 64), 19 October 2002 (JMB)

Four members met in Malham car park on a frosty morning. The frost soon cleared and the day was fine and sunny. We drove to Gordale Bridge and entered Janet's Foss Wood from the eastern end. Much time was spent recording the area above and below the foss where the carboniferous limestone ensured a rich bryoflora. Rocks in and around the beck were covered in *Brachythecium plumosum, Cinclidotus fontinaloides, Dichodontium pellucidum, Hygrohypnum ochraceum, Rhynchostegium riparioides, Thamnobryum alopecurum, Conocephalum conicum* and *Pellia endiviifolia* with its branch-tips producing the secondary branches always prominent at this time of year. Other common calcicoles on the rocks included *Bryoerythrophyllum recurvirostrum, Ctenidium molluscum, Didymodon sinuosus, Hypnum lacunosum var. tectorum* and *Tortella tortuosa.* Lower down the wood we found large patches of *Anomodon viticulosus, Neckera complanata and N. crispa* on the rocks with small quantities of *Rhynchostegiella tenella, Plagiochila porelloides* and *Diplophyllum albicans* growing with *Scapania nemorea.* The ground flora included *Cirriphyllum piliferum, C. crassinervium, Eurhynchium striatum, Mnium hornum, Plagiomnium rostratum, P. undulatum, Rhytidiadelphus squarrosus* and *Thuidium tamariscinum.* The number of epiphytic species was disappointingly low but *Brachythecium rutabulum, Eurhynchium praelongum, Hypnum cupressiforme,* and *H. resupinatum* were all recorded.

After lunch we spent time in the fields downstream of the wood. On rocks we found *Ditrichum gracile, Taxiphyllum wissgrillii* and *Porella platyphylla.* On the soil were *Cratoneuron filicinum, Homalothecium lutescens, Plagiomnium affine* and *Pohlia wahlenbergii.* A visit to a grassy slope above the field to the south of the beck, on acidic Bowland Shales, was abandoned because of pheasant shooting.

The remainder of the day was spent upstream of Gordale Bridge as far as Gordale Scar. *Fontinalis antipyretica* was growing in the beck and, in the damp grassland, *Bryum pseudotriquetrum* and *Marchantia polymorpha* ssp. *ruderalis.* On dripping rocks we saw *Eucladium verticillatum* and quantities of *Palustriella commutata var. commutata.*

Cololejeunea calcarea and Pedinophyllum interruptum, both known from this area, were not seen. However, a total of 63 species was recorded on the day.

Barningham and Brignall Banks (VC 65), 10 May 2003 (TLB)

The route taken for this meeting was northwards along Gill Beck and then westwards along the Greta at Brignall Banks. Initially along Gill Beck, among a fine display of spring flowers, it was the epiphytic bryophytes that attracted special interest. *Dicranum montanum* was found on sycamore, a first record for the vice-county. *Orthotrichum stramineum, O. pulchellum, Ulota phyllantha* and *Radula complanata* were also present. *Nowellia curvifolia* was found on rotting wood. Further down the beck, there were increasing exposures of rock, mostly sandstone but with some evidence of base enrichment. The flora included *Heterocladium heteropterum* var. *flaccidum, Anomodon viticulosus, Rhynchostegiella teesdalei* and *Jungermannia atrovirens.* A robust fertile form of *Hygrohypnum luridum* was plentiful in the stream. At the junction with the Greta, we found *Frullania*

tamarisci growing as an epiphyte on a single old oak.

The woodland along the Greta has clearly become more open in recent years from loss of elm. There are crags in various places, showing wide variation in the extent of their base enrichment. The more calcifuge species included *Hookeria lucens* and *Cephalozia lunulifolia*. There were, however, a number of more or less calcicolous bryophytes, some of them only in small quantity: *Gymnostomum aeruginosum*, *Mnium marginatum*, *M. stellare*, *Tortella tortuosa*, *Neckera crispa*, *Apometzgeria pubescens*, *Cololejeunea calcarea* and *Porella cordaeana*. Of particular note was the presence of *Platydictya jungermannioides* on a moist vertical rock face. Other species on and among the rocks included *Dicranum majus*, *Eurhynchium pumilum*, *Rhynchostegiella tenella*, *Leiocolea turbinata*, *Lejeunea cavifolia* and *Metzgeria conjugata*. Epiphytes continued to be of interest, *Zygodon conoideus* and *Metzgeria fruticulosa* being added to the list. The diversity of habitat guaranteed a long list of species, 110 in total.

Beacon Lagoons and Hollym Carrs (VC 61), 18 October 2002 (TLB)

Holderness was chosen as the venue for the autumn meeting in the expectation that it would be possible to sample the ephemeral flora of stubble fields. Sadly, the exceptionally dry autumn meant that no productive recording could be done in this habitat. Bryology was also very difficult at our first venue, Beacon Lagoons. Only a few common 'weedy' species were found, along with much *Didymodon tophaceus* on bare clay. A fertile *Bryum* on sand among reeds appeared distinctive, but proved to be a form of *B. bicolor*.

The reserve at Hollym Carrs, recently created from former arable land, was somewhat richer, though even here only 25 species were recorded. It was a pleasure to see the establishment of increasingly herb-rich vegetation, and there are several ponds. Bare clay by the ponds produced *Didymodon tophaceus*, *D. fallax* and the liverwort *Aneura pinguis*, and *Leptodictyum riparium* grew about the roots of *Salix*. Another area of exposed clay, on the vertical bank of a ditch, gave us the most notable find of the day, a few stems of the moss *Weissia rostellata*, new to the vice-county. *Dicranella schreberiana* was on the same bank. *Leskea polycarpa* was on the roots of an ash tree just beyond the northern boundary of the reserve, and an old ash tree within the reserve had some small patches of *Metzgeria furcata*.

Records

The list below includes new vice-county records and other records of note. An asterisk indicates a new or updated vice-county record. Recorders' initials: JMB = J.M. Blackburn; TLB = T.L. Blockeel; JGD = J.G. Duckett; JE = J. Egan; HL = H. Lake; RDP = R.D. Porley; CDP = C.D. Preston.

Nowellia curvifolia: (65) 34/79 On rotting wood, Needlehouse Gill, TLB, 22 June 2002.

Lophozia incisa: (65) 34/68 Turfy bank by stream, Short Gill, Barbondale, TLB, 26 July 2003.

Scapania gracilis: (65) 34/68 On sheltered rocks, Short Gill, Barbondale, TLB, 26 July 2003.

Plagiochila spinulosa: (65) 34/79 Limestone rock ledge, Uldale, TLB, 22 June 2002; 34/68 Shaded rocks in gill, Short Gill, Barbondale, TLB, 26 July 2003.

Ptilidium ciliare: (65) 34/68 Short Gill, Barbondale, TLB, 26 July 2003; 34/79 Needlehouse Gill and Uldale, TLB, 22 June 2002.

Porella arboris-vitae: (65) 34/68 On limestone, Short Gill, Barbondale, TLB, 26 July 2003; (65) 34/79 Limestone rock crevice, Needlehouse Gill, TLB, 22 June 2002.

Marchesinia mackaii: (65*) 34/68 Limestone rock face, Short Gill, Barbondale, TLB, 26 July 2003. This Atlantic species was previously known from the county only from the Carboniferous Limestone at Ingleton and from the Magnesian Limestone in the extreme south of the county in the Lindrick district.

Cololejeunea calcarea: (65) 34/68 Shaded limestone, Short Gill, Barbondale, TLB, 26 July 2003.

Cololejeunea rossettiana: (65) 34/79 on *Thamnobryum* in rock cleft, Needlehouse Gill, TLB, 22 June 2002.

Metzgeria temperata: (65) 34/79 Needlehouse Gill, TLB, 22 June 2002.

Apometzgeria pubescens: (65) 34/79 Shaded limestone, Needlehouse Gill, TLB, 22 June 2002; (64) 34/77 Scar Close, RDP and JGD, 7 October 2002.

Riccia sorocarpa: (61) 44/76 Loam with clay, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Riccia glauca: (61) 44/76 Loam with clay, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Riccia subbifurca: (61*) 44/76 Loam with clay, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Sphagnum teres: (65) 34/68 Small flush on stream bank, Short Gill, Barbondale, TLB, 26 July 2003.

Andreaea rupestris var. ***rupestris***: (65) 34/68 Grit rocks, Short Gill, Barbondale, TLB, 26 July 2003.

Andreaea rothii subsp. ***falcata***: (65) 34/68 Grit rocks, Short Gill, Barbondale, TLB, 26 July 2003.

Polytrichum alpinum: (65) 34/79 Turfy rock ledge, Needlehouse Gill, TLB, 22 June 2002.

Polytrichum strictum (62*) 44/47 Peaty soil, Pilmoor SSSI, Helperby, JMB, 14 July 2000.

Diphyscium foliosum: (65) 34/68 Short Gill, Barbondale, TLB, 26 July 2003.

Ditrichum cylindricum: (61) 44/76 Sandy loam, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Dicranum montanum: (65*) 54/01 On sycamore, Gill Beck, Barningham, TLB and JMB, 10 May 2003.

Leucobryum juniperoideum: (63) 43/38 Rotting *Castanea* log, Ecclesall Wood, JE, 27 February 2002.

Fissidens incurvus (62*) 44/67 Limestone grassland, Stonegrave, JMB, 4 November 2000.

Weissia rostellata: (61*) 54/32 Clay on vertical ditch bank, Hollym Carrs, YNU excursion, 18 October 2003; (63) 44/31 On clay soil in arable field, Wintersett, TLB, 4 December 2002.

Tortella nitida: (64) 34/77 Scar Close, RDP and JGD, 7 October 2002.

Bryoerythrophyllum ferruginascens: (64) 34/77 Scar Close, RDP and JGD, 7 October 2002.

Hymenostylium recurvirostrum: (65) 34/79 Needlehouse Gill and Uldale, TLB, 22 June 2002.

Didymodon nicholsonii (62*) 44/46 Stonework at Linton Lock, Linton-on-Ouse, JMB, 28 April 2000.

Didymodon tomaculosus (63) 43/48 On clay in stubble field, Goose Carr Lane, Todwick, TLB, 30 November 2003; 44/40 on clay at edge of ploughed field, north of Howell Wood, TLB, 30 November 2003. Recent searches for this species have confirmed its continued presence in most of the sites from which it was oringially recorded at the time of its description in 1981. The Howell Wood site is a new 10 km square.

Didymodon ferrugineus (62*) 44/67 Disused limestone quarry, Wath near Hovingham, JMB, 9 December 2000.

Microbryum rectum (62*) 44/67 Limestone grassland, Stonegrave, JMB, 4 November 2000.

Microbryum floerkeanum (63*) 43/48 On clay in stubble field, Goose Carr Lane, Todwick, TLB, 30 November 2003. Only recorded once previously in VC 63, in 1909.

Hennediella heimii (62*) 45/52 Dune slack, Teesmouth, Redcar, JMB, 27 July 2000.

Syntrichia laevipila var. ***laevipila*** (62) 44/37 Crack willow by river, Skipton-on-Swale, JMB, 1 November 2003.

Schistidium rivulare: (63*) 44/10 in concrete run-off channel, Broadstone Reservoir, HL, 31 August 2003.

Racomitrium sudeticum: (65) 34/68 On grit rock, Short Gill, Barbondale, TLB, 26 July 2003.

Seligeria pusilla (62*) 44/58 On limestone bank, Dark Gill, Beckdale, Helmsley, JMB, 10 May 2000; (65) 34/79 Limestone rock crevice, Uldale, TLB, 22 June 2002.

Leptobryum pyriforme: (61) 44/76 Sandy loam, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Pohlia elongata: (65) 34/68 Short Gill, Barbondale, TLB, 26 July 2003; 34/79 Rock crevice, Uldale, TLB, 22 June 2002.

Bryum gemmiferum: (61) 44/76 Loam with clay, Manor Farm, Eddlethorpe, CDP and JMB, 10 December 2003.

Plagiomnium cuspidatum: (65) 34/68 Limestone rock ledge, Short Gill, Barbondale, TLB, 26 July 2003.

Rhizomnium pseudopunctatum: (63) 43/19 Mickleden Beck, HL, 6 December 2002.

Plagiopus oederianus: (65) 34/79 Limestone rock ledge, Needlehouse Gill and Uldale, TLB, 22 June 2002.

Zygodon conoideus: (65*) 34/79 On sycamore, Needlehouse Gill, TLB, 22 June 2002.

Orthotrichum lyellii (62*) 44/49 On ash trunk, Cotcliffe Wood, Borrowby, JMB, 17 December 2003.

Orthotrichum cupulatum var. ***riparium*** (62*) 45/40 On rocks in River Leven, Hutton Rudby, JMB, 11 January 2000.

Orthotrichum rivulare (62*) 45/71 On rock in Kilton Beck, Clarkson's Wood, Liverton Mines, JMB, 18 May 2000.

Orthotrichum stramineum: (65) 34/79 Needlehouse Gill, TLB, 22 June 2002.

Myrinia pulvinata (62) 44/48 On willow branch by Cod Beck, South Kilvington, JMB, 19 November 2003.

Campylium stellatum var. ***protensum***: (65) 34/68 On moist gravelly-clay bank, Short Gill, Barbondale, TLB, 26 July 2003.

Amblystegium serpens var. ***salinum*** (62*) 45/52 Sandy soil, Teesmouth, Redcar, JMB, 27 July 2000.

Drepanocladus cossonii: (65) 34/68 Small flush by spring, Short Gill, Barbondale, TLB, 26 July 2003.

Brachythecium glareosum: (64) 34/77 Scar Close, RDP and JGD, 7 October 2002.

Pylaisia polyantha (62*) 44/88 On old tree trunk, Pickering Woods, JMB, 22 September 2003.

Hylocomium brevirostre: (64) 34/77 Scar Close, RDP and JGD, 7 October 2002.

BOOK REVIEW

Dolphin Watching Around the World at a Glance by **Melanie Parker**. Pp. 32, with 20 colour illustrations. 2004. £3.50 (plus £1.50 postage) from: International Dolphin Watch, 10 Melton Road, North Ferriby, East Yorkshire HU14 3ET.

This booklet is a compilation of information and contact details for 47 companies offering Cetacean-watching and 'swimming with dolphins' holidays in 19 countries. Although not claiming to be definitive, the dynamic nature of this holiday industry is illustrated by the omission of the three holiday companies advertising in the September issue of the BBC *Wildlife Magazine*.

Superficially, the watching and 'swimming with dolphins' industry seems to be one of the more exotic manifestations of eco-tourism, its links with dolphin preservation and welfare, and marine conservation in general, seemingly thin and unsupported. However, this is to misread the situation. From the Cetacean's point of view it is surely better that boatloads of people go out to watch rather than to hunt or inadvertently net them. Furthermore, the impressive spectacles and experiences that these holidays provide to an eager public have generated a substantial weight of favourable popular opinion, evidence

of which was graphically revealed in the poll conducted for the BBC TV programme *50 things to do before you die*, when "swimming with dolphins" came way ahead of the field.

Currently, customers seem more concerned with the thrills (and claimed emotional benefits) of "close encounters of the cetacean kind" than with trying to record and understand what is going on. Despite the many shipboard sightings of whales, dolphins and porpoises, actual reports of these, at least within the North Sea, are still as rare as hen's teeth. The International Dolphin Watch, publisher of this booklet, now makes specific appeals for sightings.

CAH

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ERRATUM

Unfortunately, the price, £18.99 paperback, was omitted for Clive Hambler's book on *Conservation* reviewed on p.102 of the last issue of *The Naturalist.*

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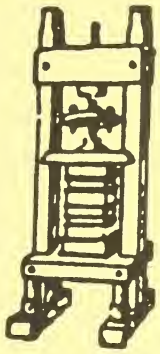

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